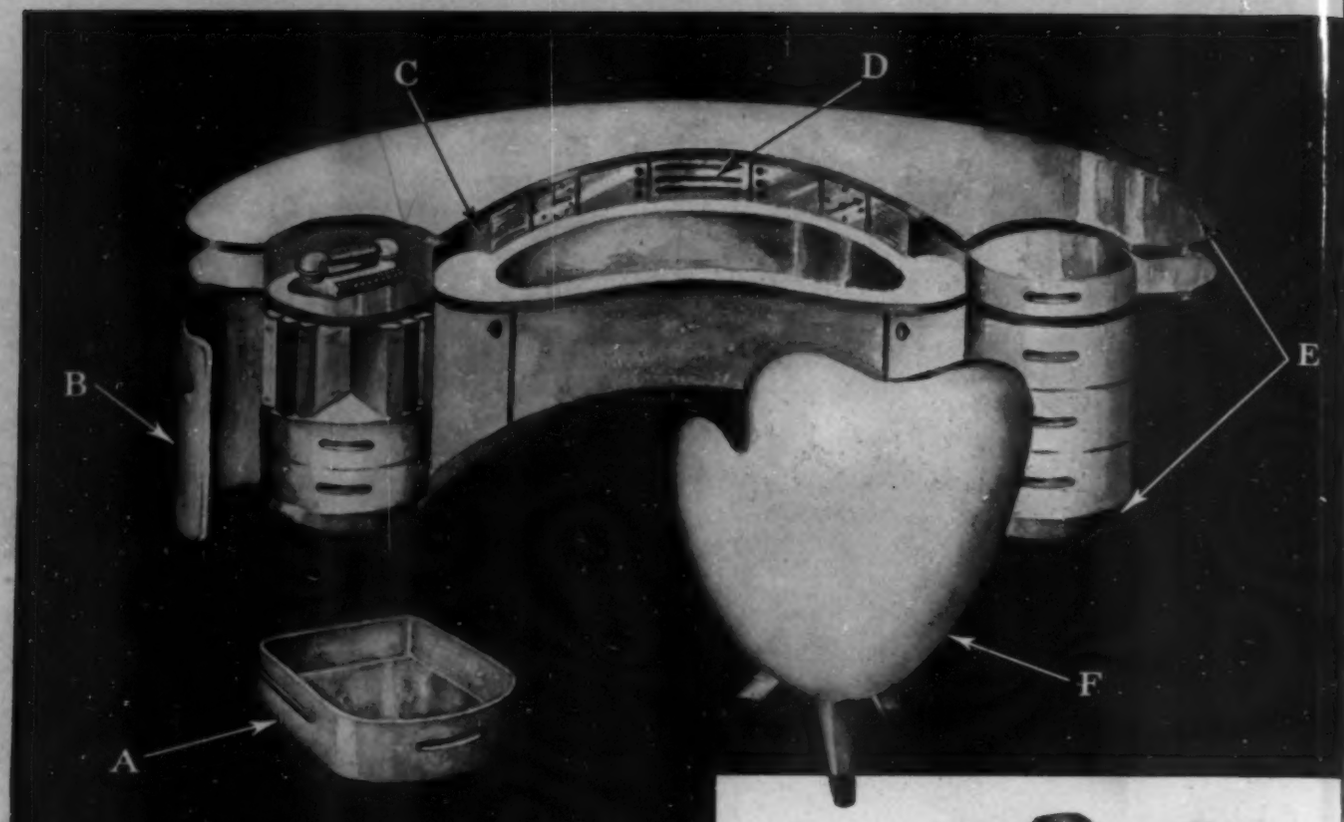
MODERN PLASTICS

NOVEMBER 1943



Has a desk a future?

LEO JIRANEK
Industrial Designer

Things you'll look for in post-war desks

A Drawers molded in one-piece of Durez plastics.

B Curved sections formed of Durez resin-bonded plywoods.

C Indirect lighting of writing surface.

D Radio and inter-communications.

E Mar-proof Durez plastic plywood base and top.

F Durez molded plastic airplane-type bucket chair for posture comfort.

WE'LL LET this sketch by Mr. Jiranek give you the answer. Perhaps you think this piece of furniture is reserved only for some future member of the Stock Exchange or his financial peer.

But looks *are* deceiving! For with the help of manufacturing economies resulting from the use of Durez plastics and plywood resins, this desk will go to market with a very modest price tag. As Mr. Jiranek points out . . .

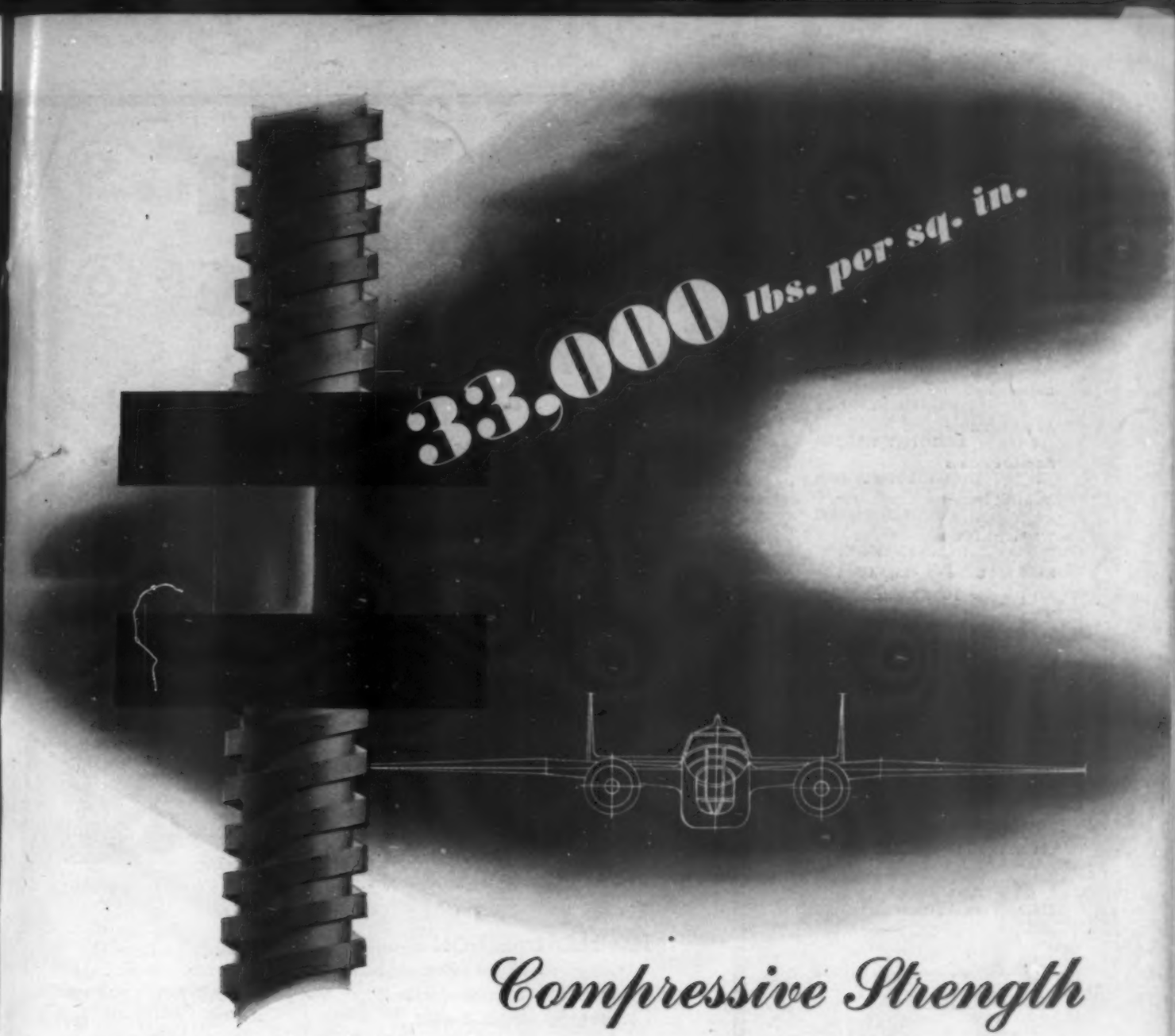
"Viewed from the angle of traditional cabinet making, the above design would be a formidable and costly proposition. Think of the hours of hand-labor that would be required to reproduce those curved surfaces alone. But exchange ordinary wood for Durez plastics and resin-bonded plywoods and see how your manufacturing problems diminish. Drawers (fig. A) for example, can be molded in *one-piece*. Drawers that will never break or warp—each a perfect duplicate of the master mold. Large surfaces such as the desk top are a "natural" for plastic-plywood. Complex curves of all sorts can be mass-produced more easily than a skillful carpenter can saw a straight line through soft pine! These materials are bound to revolutionize furniture-making."

If you could see the problems that Durez plastics and resins for bonding plywoods have solved in war production—from bridge pontoons and PT boat super-structures to the fabrication of bombers—you'd more than agree with Mr. Jiranek. What the plastic and plywood industries have learned in serving the armed forces is going to have tremendous influence on America's post-war production. Durez Plastics & Chemicals, Inc., 231 Walck Rd., N. Tonawanda, N. Y.

BUY UNITED STATES WAR BONDS AND SAVINGS STAMPS

DUREZ

PLASTICS THAT FIT THE JOB



Compressive Strength

Until recently, the Compressive Strength factor of plastic materials counted for little in the sum total of their listed properties. Since the general run of plastic applications was projected with dimensionally thin walls, any failure was more apt to occur from insufficient impact, flexural or tensile strength. Machinery applications, however, being highly engineered, did place proper importance on high Compressive Strength for such elements as cams, gears and bearings. And because of this requirement, these parts were usually fabricated from laminated phenolics or Catalin Cast Resins.

But, when the aviation industry hit the stride of its huge expansion program, and a search was made for metal substitutes for tooling purposes, it was natural that investigation was directed into plastics. Compressive Strength and Dimensional Stability, for the applications in mind, became factors of particular interest...and the choice, therefor, narrowed itself down to the use of cast resins, for in them were found the greatest potentials.

Particular interest was centered upon the free flowing quality of Catalin Casting Resins. These resins were easily cast in easily constructed, inexpensive plaster molds and provision for duplicates presented no problem.

The satisfactory production and the resultant lighter weight of cast resins for hydroform blocks, drill jigs, forming dies and checking fixtures encouraged the further projection of still larger castings . . . and the still further improvement of Catalin casting resin formulations.

As a result, Catalin Casting Resins have stepped up their Compressive Strength to 33,000 lbs. per sq. in. Shrinkage in service is only .00018 in. per in. These resins are practically unaffected dimensionally by fluctuating temperature, or water absorption.

Today, large male and female stretch molds on giant stretch presses, using a 750 ton draw, as well as Catalin punches for punch presses, are forming sheet metal into the infinite shapes necessary for faster and faster aircraft production. As a material for tooling purposes, Catalin is unquestionably rendering a most vital war service . . . and poses itself, too, as one for important consideration in future industrial developments.

Cast Resins
Molding Compounds
Liquid Resins

CATALIN
CORPORATION

ONE PARK AVENUE • NEW YORK 16, N. Y.

ONE · OF · A · SERIES ON · THE · PHYSICAL · PROPERTIES · OF · PLASTIC · MATERIALS

Modern Plastics

INCLUDING *Plastics Engineering*

VOLUME 21 NOVEMBER 1943 NUMBER 3

Editor CHARLES A. BRESKIN

Managing Editor
HARRIET B. JOSEPHS

Technical Editor
DR. GORDON M. KLINE

Engineering Editor
FRED B. STANLEY

Associate Editor
DOROTHY MARTIN

Associate Editor
LAURA E. MORRISON

Assistant Editor
SHIRLEY SMARR

Washington Editor
R. L. VAN BOSKIRK

Readers' Service EDNA SILEN

Art Director JOSEPH BOLOGNA

BUSINESS STAFF

ALAN S. COLE,
General Manager

P. H. BACKSTROM, M. A. OLSEN

DANIEL M. BROADS Production
R. G. GERMAISE Circulation
WALTER S. ROSS Promotion

J. M. CONNORS
221 N. La Salle St. Chicago 1, Ill.

R. C. BEGGS
815 Superior Ave., Cleveland 14, Ohio

L. B. CHAPPELL
427 West 5th St., Los Angeles 13, Calif.

Member Audit Bureau of Circulations

● All editorial contents having bearing on military subjects have been released for publication in MODERN PLASTICS by the Armed Services.

GENERAL INTEREST

The Mustang's bomb rack 75
Resin-bonded marine bearings 78
Supplementing surgery with vinyls 80
Industrial application of phenolic resins 84
Replacements for rubber coated fabrics 89
A redesigned dental surveyor 94
Society of Plastics Engineers' Meeting 95
P.M.M.A. Handbook 146

PLASTICS ENGINEERING

Importance of ethyl cellulose 101
New application of heatronic molding 106
Housings for tapping attachments 110

TECHNICAL SECTION

Injection molding of nylon 115
Photoelastic detection of strains 121
Resin impregnation of wood 124
Technical briefs 130
Plastics digest 132
U. S. plastics patents 134

NEWS AND FEATURES

Product development 82
Plastics in review 92
Machinery and equipment 142
Publications 144
Washington round-up 148
In the news 152
Society of the Plastics Industry 158
London letter 160

EXECUTIVE and EDITORIAL OFFICES: 122 E. 42nd St., New York 17, N. Y. WASHINGTON 6, D. C., OFFICE: 625 Colorado Bldg., 14th & G Sts.

Published the 5th of each month by Modern Plastics, Incorporated. Publication Office, Twentieth and Northampton Sts., Easton, Pa. Subscription price $5.00 per year, $8.00 for 2 years in U. S., its possessions and South America. Canadian subscriptions $5.50 per year, $9.00 for 2 years; all other countries $6.00 per year, $10.00 for 2 years, payable in American money or its equivalent. Price 50¢ per copy.

Copyright 1943 by Modern Plastics, Inc. All rights reserved.

Printed in U. S. A. Entered as second class matter May 28, 1940, at the Post Office at Easton, Pa., under the act of March 3, 1879. Member of the Audit Bureau of Circulations. Back numbers 3 months or more preceding current issues, when available, $1.00 each.

Modern Plastics is fully protected by copyright and nothing that appears in it may be reprinted, wholly or in part, without special permission.

THIS is the Velon filament department of Firestone Industrial Products Company's plastics extrusion plant at Paterson, New Jersey.

A unit of Firestone Tire & Rubber Company, this plant's production facilities include a battery of five National extruders, designed and built specifically for the fast, efficient extrusion of this vinylidene chloride compound.

By means of high-speed orientation equipment, multiple extruded strands are reduced simultaneously to almost any desired size. This makes possible the weaving and braiding of heavy-duty, long-wearing, but colorful fabrics for tomorrow's railway, automotive and theater seating, or sheer, filmy materials for postwar drapes, women's shoes, hats and handbags. Now, of course, these filaments are in war-work almost exclusively.

The sound, solid engineering that went into the machines that extrude Firestone's Velon so successfully is available—together with the services of National's own Pilot Plant—to all who seek to solve problems in plastics.

CLIFTON DIVISION

Plastics Division

NATIONAL RUBBER MACHINERY COMPANY

General Offices: Akron, Ohio

REDESIGN WITH INSUROK

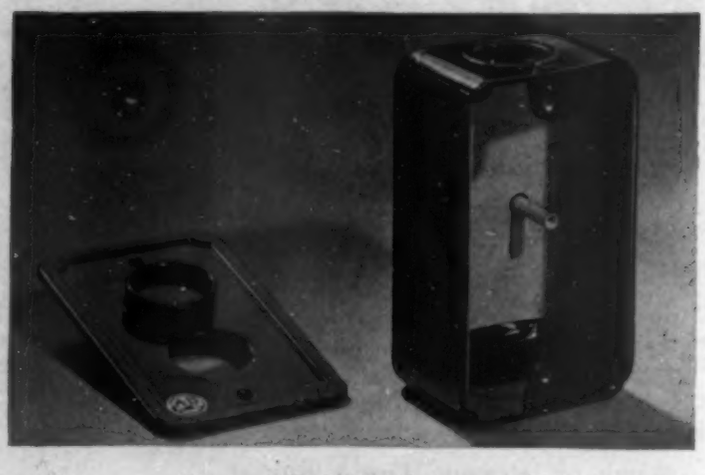
MANY products, improved by redesign and restyling, are now far better products than ever. Redesign of commercial products did not, of course, stop with the war. It has been and *is* a continuous process that is going on *now*.

Versatile INSUROK plastics, because of their wide range of physical, chemical and dielectric properties, are being used to solve a host of redesign and restyling problems.

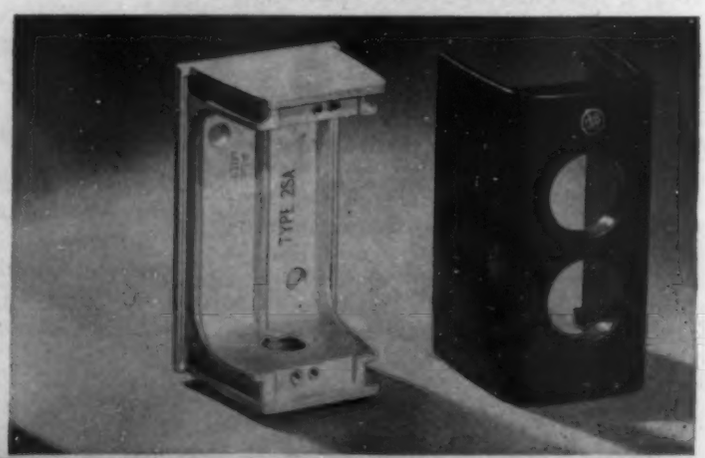
The particular grade of Molded INSUROK used for the new push-button switch, which won an award in the Annual Electrical Manufacturing Product Design Contest, was chosen because of its good insulating properties, permanency of finish and appearance.

Many types of Richardson plastics are speeding Victory today at home and on the combat front. If your product needs redesigning, let Richardson Plasticians help you. They will recommend the right *kind* of plastic for the job.

The old style Allen-Bradley switchbox required three screws and because of its construction made terminals and wiring hard to get at.



The new Allen-Bradley design was a big improvement—required only one screw—kept out dust and fine particles—opened on both sides as well as the front. This was accomplished by fitting the ribs of the cover into grooves in the base.



INSUROK
Precision Plastics

The RICHARDSON COMPANY

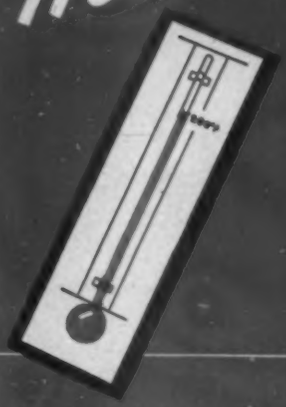
MELROSE PARK, ILL. NEW BRUNSWICK, N. J. FOUNDED 1858 INDIANAPOLIS 1, IND. LOCKLAND, CINCINNATI 15, OHIO
DETROIT OFFICE 4-252 G. M. BUILDING, DETROIT 2, MICHIGAN NEW YORK OFFICE 75 WEST STREET, NEW YORK 6, N. Y.

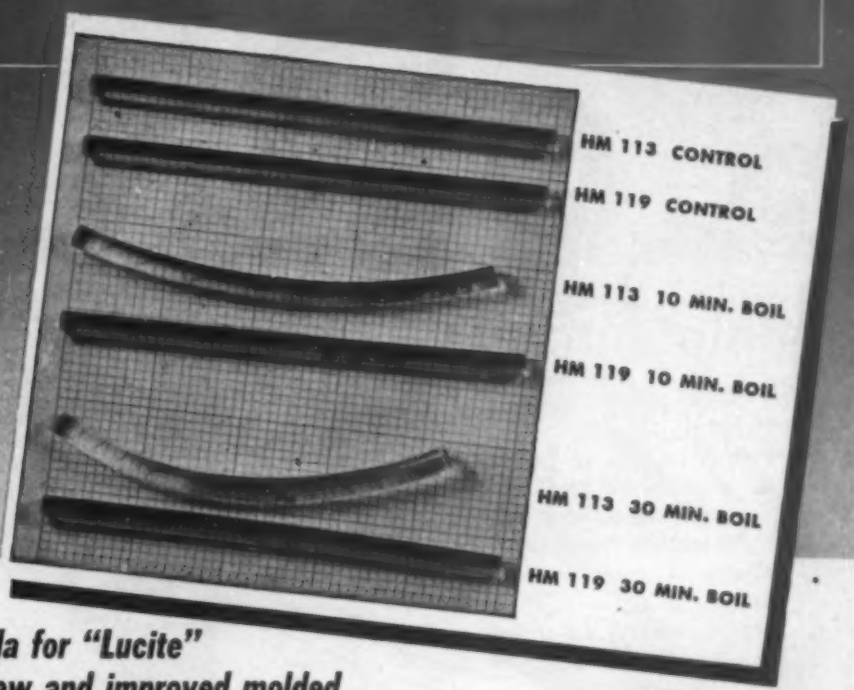
HOW NEW HEAT-RESISTANT "LUCITE"

methyl methacrylate resin

MOLDING POWDER

can help solve your wartime product problems





AT RIGHT—unretouched photograph of test rods extrusion-molded from General Purpose "Lucite" (formula HM-113) and from *heat-resistant* "Lucite" (formula HM-119). **AT TOP**, 5" rods before heat treatment. After 10 minutes' boiling in water (212°F), rod molded from General Purpose "Lucite" **(CENTER)** shows dimensional change of 8%, and after 30 minutes' boiling, 14.5% change. Rods molded from *heat-resistant* "Lucite" showed no change in form, or in mechanical, thermal, optical, molding or general properties, even after 30 minutes' boiling. (Heat resistance is influenced also by extrusion variables.) This test, employing rods of a single diameter, suggests how *heat-resistant* "Lucite" will allow creation of many new molded acrylic products to serve more purposes than ever before.

New Du Pont formula for "Lucite" allows creation of a host of new and improved molded products to meet broadening war requirements.

ALTHOUGH not intended to replace the General Purpose "Lucite" molding powders used so successfully in the past, Du Pont's new *heat-resistant* "Lucite" will prove invaluable in use where increased heat resistance (200°F) in the molded methyl methacrylate thermoplastic is essential.

The mechanical, electrical, optical and molding properties of *heat-resistant* "Lucite" are approximately the same as those of General Purpose "Lucite." And this material can be molded successfully by present compression, injection and extrusion methods. BUT—the heat resistance of articles molded from the *new* "Lucite" may be *30-40°F higher!*

The photograph above is visual evidence of how *heat-resistant* "Lucite" will assist engineers, designers and production men in the building of new and better molded products for the needs of war—and for ensuing peace as well.

DU PONT

REG. U. S. PAT. OFF.

TYPICAL APPLICATIONS FOR "LUCITE"

Flying light lenses . . . reflectors for military vehicles . . . cases for lamps and batteries . . . automobile blackout lenses . . . insulation for radio equipment . . . dial and meter faces . . . medical and dental instruments . . . automobile instrument lenses . . . airport signal light lenses . . . electrical switchboard color caps . . . railroad signal light lenses . . . transparent coverings for industrial lights . . . bathroom fixtures for barracks and battleships . . . *and scores of other applications.*

BACK THE ATTACK—WITH WAR BONDS

FREE BOOKLET ON *HEAT-RESISTANT* "LUCITE"—Contains valuable information for molders, designers, engineers and production men. For your *free* copy, or for advice on the use of *heat-resistant* "Lucite" for your products, write on your business letterhead to: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N.J., or 5801 So. Broadway, Los Angeles 3, California.

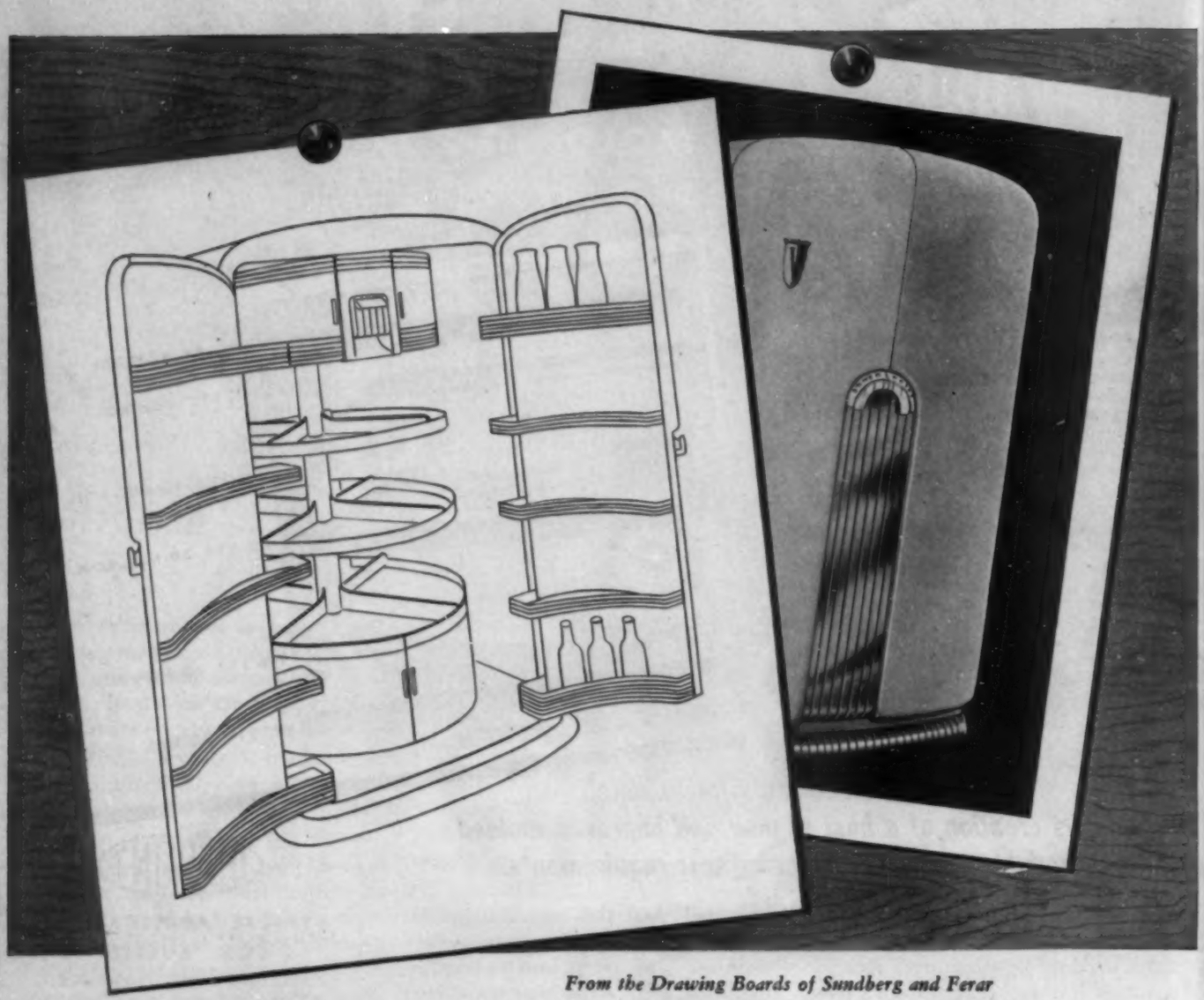
ARMY (E) NAVY

DU PONT PLASTICS

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Foodkeeping "Merry-go-round"

PORTRAYED IN PLASTICS



From the Drawing Boards of Sundberg and Ferar

Homemakers' dreams will come true if this revolving shelf principle in refrigerator design materializes after the war. And it can materialize, thanks to plastics and modern molding methods.

Designers propose circular plastic shelves to eliminate reaching for food in the back; plastic shelves built into plastic doors to utilize space between circular interior and rectangular exterior. The automatic ice cube dispenser housing and the entire cabinet can be molded of porous plastic material of excellent insulating quality.

Whether your plans for the future include production of refrigerators, other home appliances, office equipment, industrial apparatus, or anything decorative, mechanical or both, investigate the advantages of plastic molding today. Kurz-Kasch design engineers, molders and production experts can help you select the right plastics for the job, help you plan and produce . . . giving you the benefit of more than a generation of plastic molding experience.

KURZ-KASCH

For over 25 years Planners and Molders in Plastics

Kurz-Kasch, Inc., 1417 South Broadway, Dayton, Ohio

Branch Sales Offices: New York • Chicago • Detroit • Los Angeles • Dallas • St. Louis • Toronto

Canada. *Export Offices:* 89 Broad Street, New York City

WAR MESSAGE

When you look at your pay check, be more enthusiastic about the amount deducted for War Bonds than about the money you get. The money you get now will be somebody else's in a few days as you pay your living expenses. But the money in Government Bonds will be yours for ten years or more. So, for your own sake, increase your percentage in Bonds.

LUMARITH*

A Celanese Plastic

******Trade Marks Reg. U. S. Pat. Off.*

The art of the molder

This odd picture might look like some deep-sea monster or the dream of an ultra-modern artist. Actually, it is a very practical illustration of ultra-modern production in plastics. It shows how production design and molding technique turn Lumarith molding materials into all the parts of the transparent dust mask in one injection molding shot.

This superior type mask is turned out quickly—ready for fast assembly. It is tops in wearing comfort because it is lightweight and a slow heat conductor. Transparent throughout, it is easy for the worker to keep it safe-clean, to check against dust leaking into the breathing chamber. Construction is so simplified, the entire mask can be taken apart, and cleaned in a few minutes.

Lumarith molding materials can be molded to close tolerances—delivering products and parts that are light, tough and resistant to adverse conditions.

The Celanese Celluloid Corporation can help you convert to molded plastics. It works with the molders and is, therefore, in a position to put you in touch with available molders to get a definite quotation. You are invited to draw upon our documented experience and laboratory data to speed up your transition to plastics. We will be glad to assist you on both your short and long range plans.

CELANESE CELLULOID CORPORATION, *The First Name in Plastics*, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16. *Representatives:* Dayton, Philadelphia, Cleveland, Chicago, St. Louis, Detroit, Los Angeles, Washington, D. C., Leominster, Montreal, Toronto, Ottawa.

REED-PRENTICE

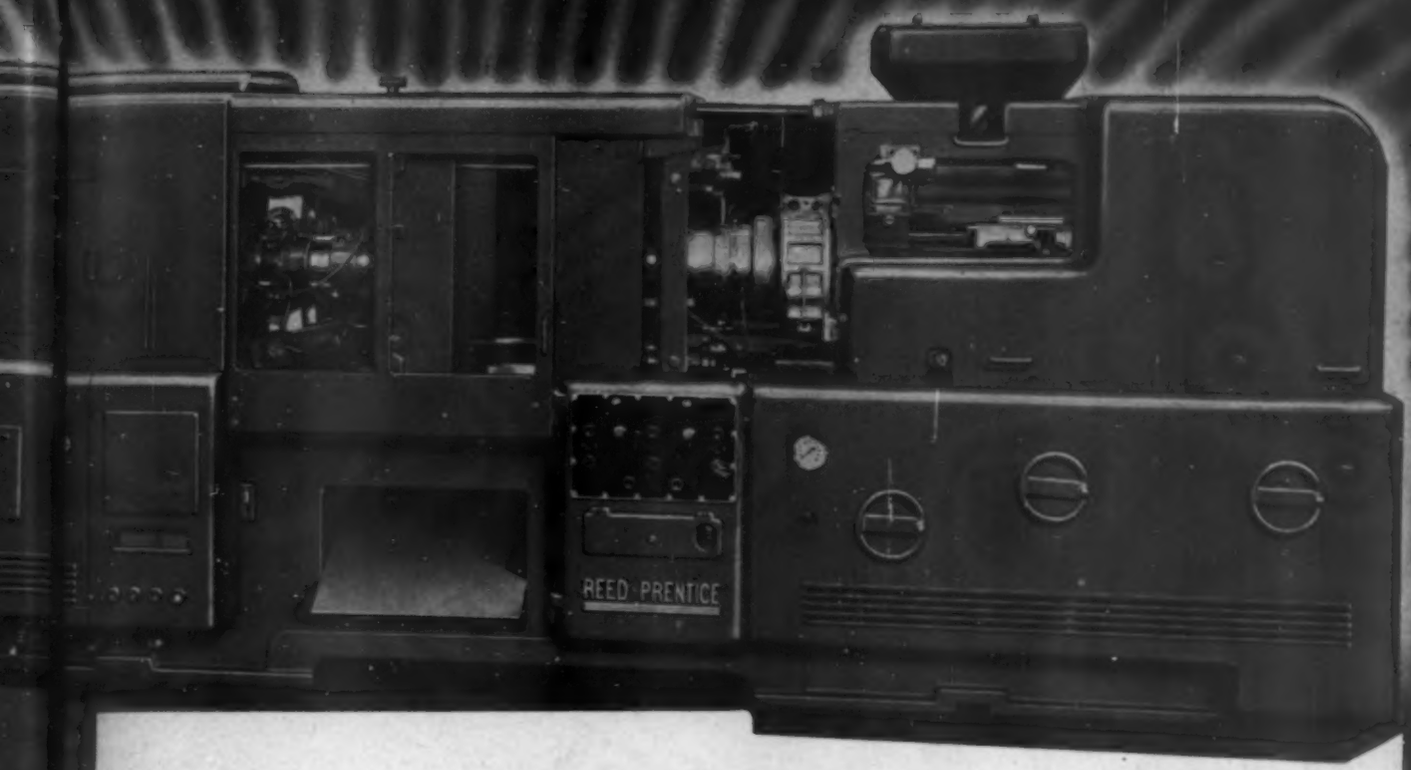
NEW 10-F
16 and 22 ounce
PLASTIC INJECTION MOLDING MACHINES

FEATURES INCLUDE:

- Newly designed frame construction. Mold adjustment controlled by pushbutton. Adjustment obtained by two large diameter screws driven by electric motor.
- New model locking mechanism provides exceptionally high clamping pressure.
- Large capacity heating cylinder easily mounted and removed.
- All pipes, electrical controls and hydraulic equipment are completely accessible.
- Automatic ejection provided at center and four corners of die plates.
- Die plate and plunger controlled automatically. Manual operation instantly obtainable.
- New and rugged safety doors incorporate electric and hydraulic interlock.
- Cooling system for dies built into machine. All valves easily accessible.

Read-Prentice 10A-4 oz., 10D-6 oz. and 10D-8 oz. machines are the predominant choice of injection molders.

ANNOUNCES . . .



SPECIFICATIONS

10-F PLASTIC INJECTION MOLDING MACHINES	16 oz.	22 oz.
Ounces molded per shot	16	22
Capacity of feed hopper, lbs.	80	80
Diameter of injection plunger	3¼"	3¾"
Diameter of hydraulic injection cylinder	12"	14"
Time required for injection stroke	1.6	2.4
Pressure on material, lbs. per sq. in.	27,000*	28,000
Size of die plates	30" x 30"	30" x 30"
Clearance between top and bottom frame members	29"	29"
Mold opens	16"	16"
Maximum die height	20"	20"
Minimum die height	8"	8"
Mold closing pressure, tons	600	600
Length by width by height	210" x 54" x 79"	210" x 54" x 79"
Weight, tons	14	14½
Motor required, 1200 RPM	40 HP	40 HP

* Higher pressure available at extra charge

BRANCH OFFICES
1213 W. 3rd. St.
Cleveland. Ohio
75 West St.
New York City. N. Y.

REED-PRENTICE CORP.

MAIN OFFICE
WORCESTER
MASS. U. S. A.

TOUGH *BUT NOT ROUGH!*

The highly complicated mold for the inside of an airplane ignition head, successfully plated at Hartford Chrome.

Chromium is tough but not rough! It's second only to the diamond in hardness, smooth-as-silk with its lustrous finish.

That's why chromium plated molds have so many distinct advantages.

Tough chromium resists corrosion, smiles at harsh abrasive materials.

Smooth, highly polished chromium improves the flow of the compound, and yields free extraction of the molded part.

Chromium plating prevents breakdowns, expedites production, salvages rejects.

The inherent advantages of chromium plated molds are no longer theoretical. They have been made a reality at Hartford Chrome, by dint of diligent research and unusual know-how.

Hartford Chrome invites your inquiry and an opportunity to discuss your problem with you.

Serving New England, New York & New Jersey

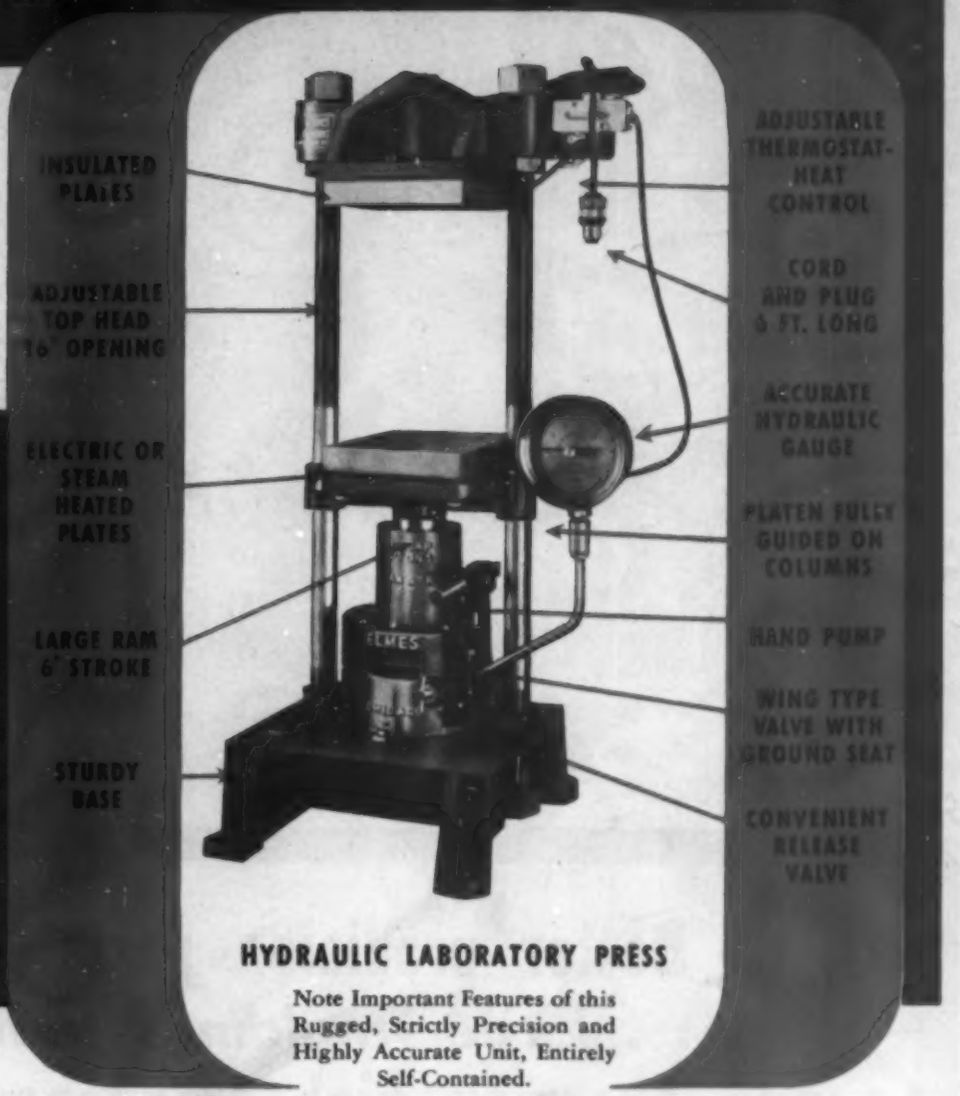
Write for free reprint of trade paper article "Chromium Plating Plastic Molds". It has valuable information for you.

HARTFORD CHROME
CORPORATION
525 PARK STREET • HARTFORD • CONN

Licensed by United Chromium Inc.

Pioneer Builders of Hydraulic Presses . . . Individual Pump or Accumulator Operated

WAR-TIME PRODUCTION ACCURACY WILL BE DEMANDED FOR PEACE-TIME MANUFACTURING



HYDRAULIC LABORATORY PRESS

Note Important Features of this Rugged, Strictly Precision and Highly Accurate Unit, Entirely Self-Contained.

ELMES LABORATORY PRESSES NOW IN THE SERVICE OF SCORES OF INDUSTRIAL LABORATORIES, COLLEGES AND UNIVERSITIES

Today, government specifications call for hair-breadth accuracy—extremely close tolerances.

Tomorrow, postwar manufacturing will require even greater accuracy. For all predictions indicate that peacetime products will be lighter, capable of heavier loads, longer lasting and require minimum maintenance attention.

Here are just a few of the innumerable uses of this Elmes Laboratory Press: plastic moulding, blocking, breaking tests, briquetting, cake forming, forcing, forming, gluing, laminating, compression tests, dehydrating, drawing, embossing, spring testing.

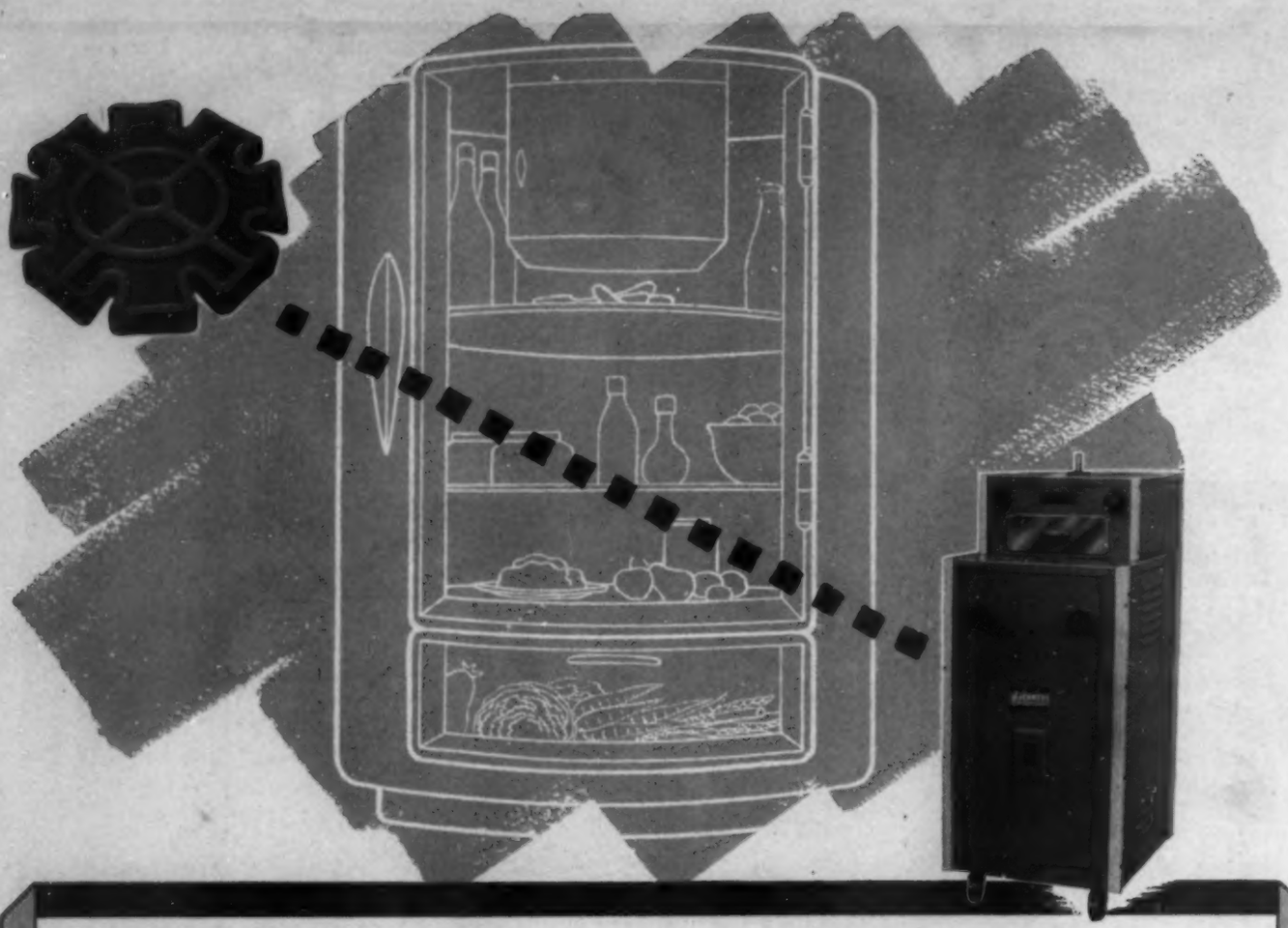
A member of the Elmes Engineering Staff will gladly collaborate with you in the use of this press in your manufacturing operation.

ELMES ENGINEERING WORKS of AMERICAN STEEL FOUNDRIES, 225 N. Morgan St., Chicago

ELMES HYDRAULIC EQUIPMENT

Also Manufactured in Canada

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES



Better precision parts today
. . . *larger moldings tomorrow*
with Thermex high frequency heating!

Tomorrow's electronic magic is right here today—in Thermex high frequency heating! It's ready to double your press output of critical war products, by speeding-up time cycles fully 50%. It's ready to raise the quality of your intricate or simple moldings—greatly improving flow properties and structural strength by means of rapid, uniform temperature rise throughout the preforms.

Thermex is also ready to expedite large post-war moldings—such as refrigerator cases, because size of molding has practically no effect on Thermex efficiency.

Further information or application engineering assistance is yours for the asking.

THERMEX

THE FIRST
INDUSTRIAL HIGH FREQUENCY
HEATING EQUIPMENT

A GIRDLER PRODUCT

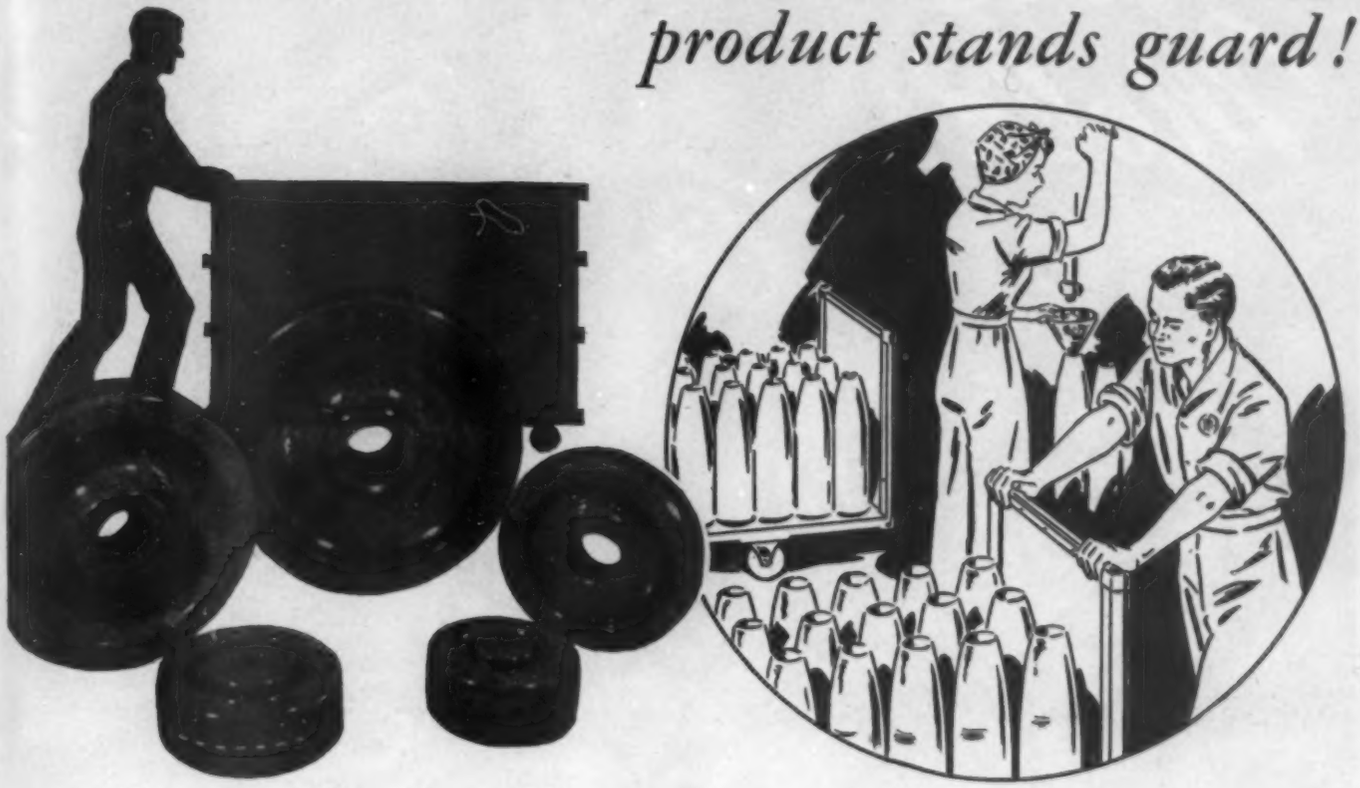
BUY *Another* WAR BOND THIS WEEK

The GIRDLER CORPORATION - *Thermex Division* - Louisville, Ky.

Where a static spark means sure disaster . . . a

CONTINENTAL-DIAMOND

product stands guard!



CELORON *molded plastic*

static grounded factory truck wheels

CELORON molded plastic *static grounded* factory truck wheels...are protecting munitions workers, plants and munitions from damage and destruction. Being NON-metallic, the wheels themselves throw no sparks when rolling on concrete or metal floors. Being a molded plastic and a non-conductor, CELORON engineers have been able to build into the wheel grounding elements which kill static electricity.

In this important war application of a C-D product, CELORON engineers have taken full advantage of the unique combination of properties provided in CELORON.

F43

LIGHT WEIGHT
GREAT STRENGTH
NON-METALLIC
HIGH DIELECTRIC STRENGTH
WORKABILITY
NON-CORROSIVE
MOISTURE RESISTANCE
ATTRACTIVE APPEARANCE
ECONOMICAL

A wealth of "know how", accumulated during 30 years of research, manufacture and application of "plastics", enables C-D engineers to help you solve your "What Material ?" problems. Send today for bulletin GF-3, C-D engineers will be glad to study your problems when you give the word.

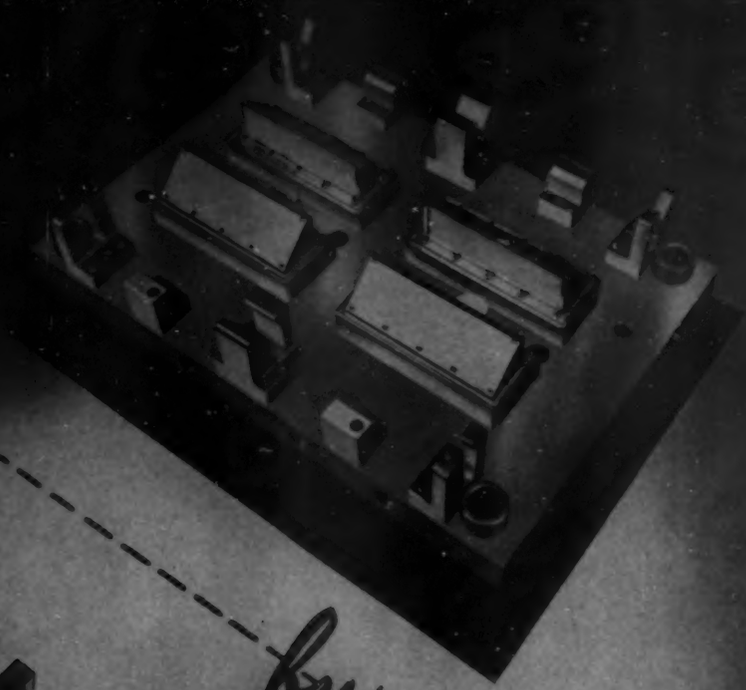
DISTRICT OFFICES:
New York • Cleveland • Chicago • Spartanburg, S.C.
West Coast Rep., Marwood, Ltd., San Francisco
Sales Offices in principal cities

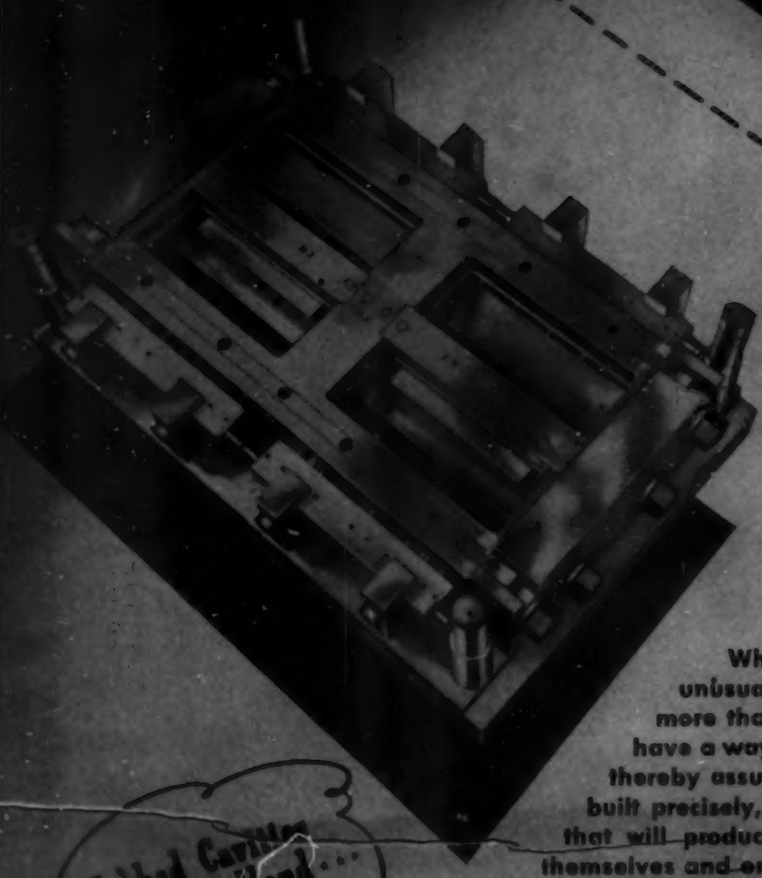
CELORON wheels are sold through
LEWIS SHEPHARD CO., Watertown, Mass.

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

More Molds by MIDLAND





Hobbed Cavities by Midland...

When the mold for a plastic part involves any unusual features, becomes a bit intricate—and more than usually difficult to execute, molders have a way of turning the job over to Midland, thereby assuring themselves of a mold that is built precisely, that will operate smoothly, and that will produce parts that reflect credit on themselves and on their customers as well.

This four cavity compression mold, for plastic parts of tank periscopes has more than sixty precision parts, all finished to a maximum tolerance of .0005". Most of our work today, while related to the war effort, is increasing the experience and perfecting the technique we will soon be employing on innumerable peace time products.

SEND *YOUR* TOUGH MOLD JOBS TO MIDLAND!

D&E

MIDLAND DIE AND ENGRAVING COMPANY

1800 W. BERENICE AVENUE . . . CHICAGO, ILLINOIS

Makers of Plastic Molds • Die Cast Molds • Engraved Dies • Steel Stamps • Hobbings • Pantograph Engraving

Tomorrow's headlines in plastics come from Eclipse today...

in COMPRESSION · INJECTION · EXTRUSION

PRACTICALLY every industry today can point to some NEW use of plastic moulding developed at Eclipse. For Eclipse designers, engineers and craftsmen admit of no limitations to progress in their thorough knowledge of all plastic materials. A long list of "FIRSTS" demonstrate the successful application of this pioneering instinct and experience — new adaptations of plastics that have improved equipment design, appearance, operating efficiency, lowered production time and cost, and saved vital metals.

DRAWER PULL BY ECLIPSE

FOOT TUB BY ECLIPSE

ECLIPSE PLASTIC MOULDINGS

Today's Working Partner to all Important Industries

SEE ECLIPSE FIRST . . . for Quality Plastic Mouldings

CONSULT ECLIPSE NOW for a practical and satisfactory solution to plastic moulding problems for today's and "tomorrow's" post-war product plans. Send blueprint or sample for quotation.

FAN BY ECLIPSE

Eclipse **MOULDED PRODUCTS COMPANY**

5151 NORTH THIRTY-SECOND STREET • MILWAUKEE 9, WISCONSIN.

CHICAGO · DETROIT · NEW YORK · CLEVELAND · KANSAS CITY

COMPRESSION . . . INJECTION . . . EXTRUSION MOULDING IN ALL PLASTIC MATERIALS

MODERN PLASTICS

for a Precision Tool . . .

. . . that Provides a MODERN Method of Checking Micrometers and Other Precision Inspection Devices

Sav-Way's new set of Master Setting and Checking Rolls is housed as befits a precision tool of this calibre, in a modern transparent plastic case.

Precision tools and inspection devices are only as accurate as the methods and gages by which they are set and checked. When anvils are worn unevenly, flat gage blocks cannot give accurate readings. Sav-Way Master Setting and Checking Rolls provide for the first time a really accurate means of checking micrometers, snap-gages, amplifiers, dial indicators, and other inspection devices, under all conditions of wear.

SAV-WAY MASTER SETTING AND CHECKING ROLLS

The set consists of 20 rolls ranging from .100" to 2.000" in diameter. Rolls are hardened, ground, and lapped to X gage tolerance. They are deep frozen before finish grinding to eliminate internal strains and provide accelerated ageing.

Send for Illustrated Literature

Sav-way INDUSTRIES

★ Products Division ★

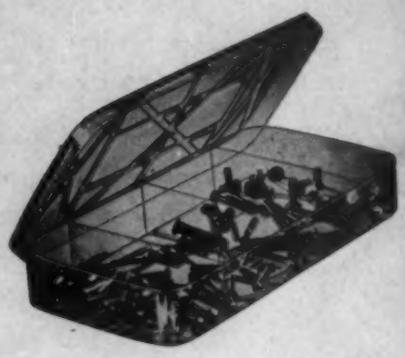
4875 EAST 8-MILE ROAD • BOX 117, HARPER STATION

DETROIT 13 • MICHIGAN

PRODUCERS OF SAV-WAY HAND AND HYDRAULIC GRINDERS • SAV-WAY GOLD SEAL SPINDLES
PLUG GAGES • PRECISION AIRCRAFT AND AUTOMOTIVE PARTS

STRONG LOW-PRICED TRANSPARENT UTILITY BOXES

STOCK MOLD or CUSTOM MADE



● We manufacture a complete line of sturdy drawn transparent plastic boxes in all shapes and sizes. Typical models are shown in photo. Every size and shape can be manufactured to meet specifications. Rounds, squares and oblongs are all available, and inserts and partitions may be inserted to meet your requirements.

These boxes are presently being used by the Army, Navy and Marine Corps for a great many purposes. They are used in war plants for storing and routing subassemblies and for small parts in repair and service departments. They give protection and visibility at the same time.

Production facilities are ample to handle large orders. Prices and samples will be sent on request.

End use must be permissive under WPB rules and regulations for sample requests and orders to be filled.

We also manufacture plastics in other forms: injection and compression molded boxes; extruded rods, tubes and special shapes *including collapsible tube bodies;* acetate and butyrate sheet cut to size in thicknesses from .003" and up.

THE GREAT AMERICAN PLASTICS CO.

"Plastics Fabricated by Every Method Known to Industry"

INJECTION • EXTRUDING • COMPRESSION • TRANSFER MOLDING • HOLLOW MOLDING & FORMING • SHEETS • ROD-TUBES AND SPECIAL SHAPES

Telephone: Leominster 1650 • LEOMINSTER, MASSACHUSETTS • Teletype Leominster 295

New York City Sales Agency: 27 West 20th Street • Chelsea 3-0267-8

Safeguarding the Signal of Hope

THE MARGIN BETWEEN being lost at sea and saved at sea is often a narrow one—men's lives can depend on the perfect functioning of the projector and flares in the Navy's "Abandon Ship" signalling kit with which life rafts are equipped. "Keep your powder dry" is a matter of prime necessity, and calls for packaging that provides maximum toughness and moisture protection.

EACH CARTRIDGE IS SEALED in a cellulose acetate capsule, colored to show the color of the flare. Capsules and pistol are sealed in a transparent acetate canister, which protects the flares and pistol after the metal outer container has been opened and thrown away. It is a model of protective packaging. It speaks for the thousands of other applications in which the advantages of acetate can play an important part.

THE COMBINATION OF qualities inherent in acetate, and developed by Hercules research, is unique in the field of plastics. To the products of war and peace, acetate brings lightness as well as toughness . . . clarity as well as color. It is stable, flexible, economical, easy to work. For literature, and the names of those who make plastics based on Hercules acetate, address Department MP-113.

Canister and capsules made by Celluplastic Corp., from Nixon Cellulose Acetate Molding Powder and Hercules Acetate Flake.

HERCULES

CELLULOSE ACETATE

★

TOUGH · FLEXIBLE · STABLE
LIGHTWEIGHT · ECONOMICAL · CLEAR

HERCULES POWDER COMPANY Incorporated · **WILMINGTON, DELAWARE**

Copyright 1943, Hercules Powder Company

DOD-75

TRANSPARENT PLASTICS BY

Reynolds

Our organization, constantly improving its methods, specializes in plastic fabrication by compression . . . injection . . . extrusion . . . and sheet forming.

Light weight, transparent turret canopies, by Reynolds, help to give the margin of Victory to Allied fighters and bombers.

Every vital ounce of weight, saved by plastics, means they can fly higher...faster...and farther...while carrying heavier loads of bullets and bombs...Let Reynolds take your plastics problems, design or redesign, engineer, build the molds and produce to your satisfaction.

REYNOLD'S MOLDED PLASTICS

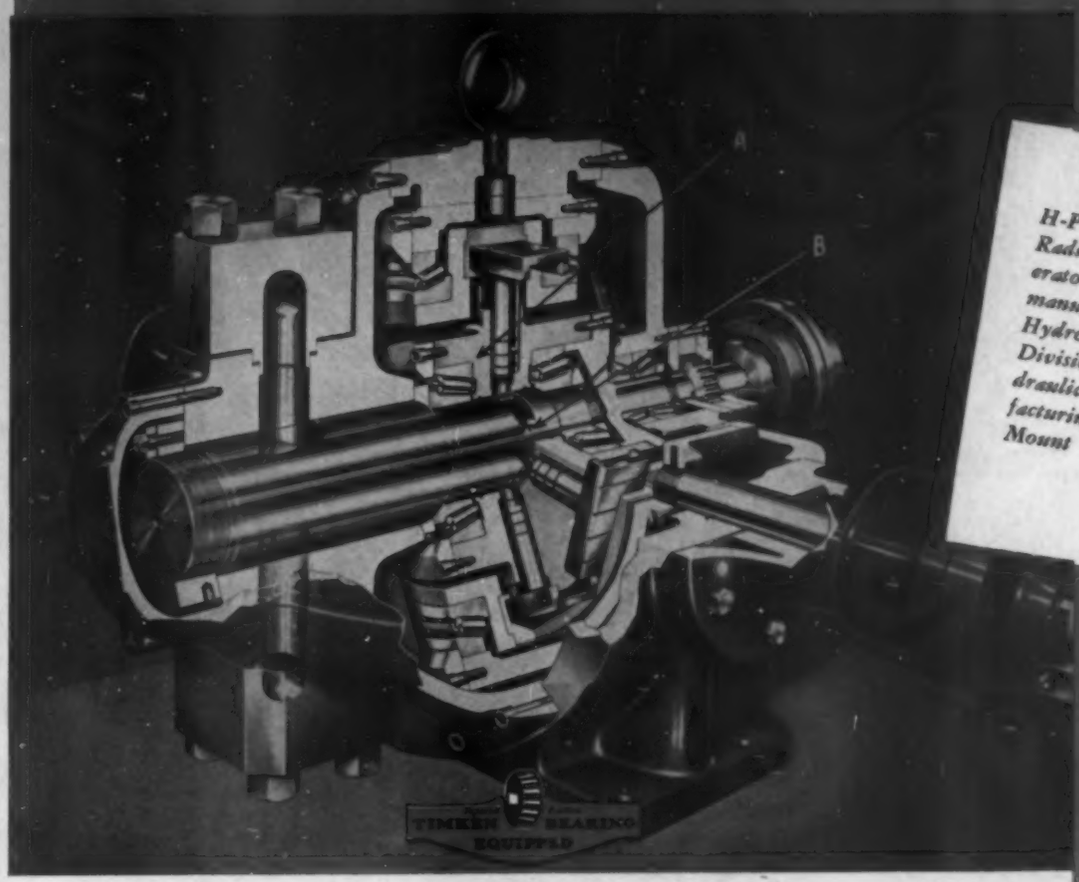
CAMBRIDGE, OHIO

SALES ENGINEERS IN ALL PRINCIPAL CITIES

DIVISION OF REYNOLD'S SPRING COMPANY, JACKSON, MICHIGAN

Pioneering

FOR IMPROVED PERFORMANCE IN PLASTICS EQUIPMENT . .



H-P-M Hydro-Power Radial Pressure Generator designed and manufactured by the Hydro-Power Systems Division of the Hydraulic Press Manufacturing Company, Mount Gilead, Ohio.

PLASTICS manufacturing equipment of all kinds needs Timken Tapered Roller Bearings for maximum speed, accuracy, endurance and economy.

Most of the auxiliary equipment used in plastics production already uses Timken Bearings—has used them for years; such equipment as lathes, grinders and drilling machines.

A good example of sustained precision made possible by Timken Bearings is the H-P-M Hydro-Power Radial Pressure Generator used to supply power to H-P-M All-Hydraulic Injection Molding Presses.

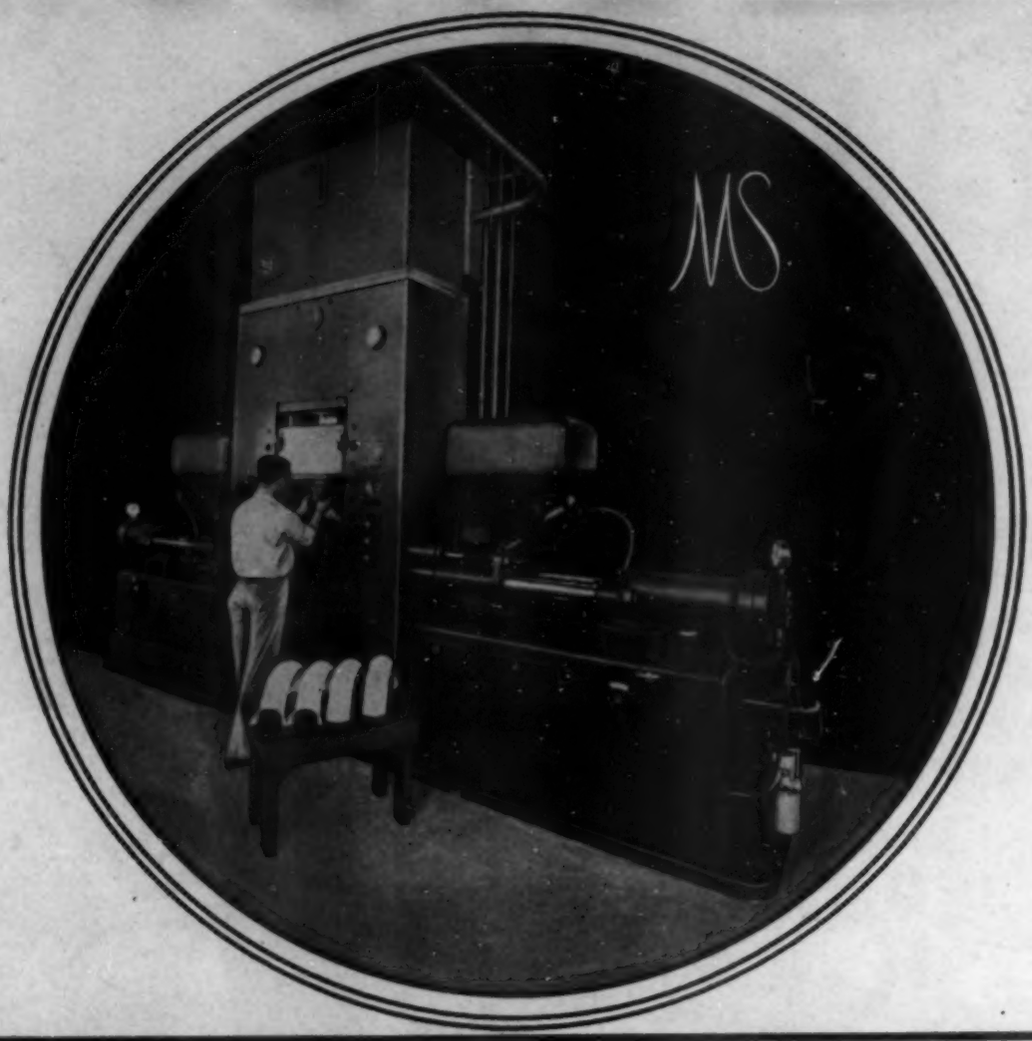
In this pump the stationary valve pintle A and the high-speed cylinder rotor B are held with a minute operating clearance between them by means of Timken Bearings of extreme precision. This application assures continued operation with freedom from troubles such as excessive wear—or even seizure of the parts.

Timken Bearings are pioneering in the plastics industry as they have pioneered in one industry after another for more than three decades. The Timken Roller Bearing Company, Canton, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



PLASTIC MOLDING

that meets exacting requirements

Our combination of experienced personnel and the most modern equipment gives you the finest service in injection molding — meets your exacting requirements promptly, efficiently, accurately — from a fraction of an ounce through 18 ounces per shot.

Our presses, along with a complete complementary equipment, include one of the four 18-36 ounce capacity presses available for custom molding. We installed a press of this capacity to answer demands for complete dash panels, garnished moldings, and similar trim.

ARMY E NAVY

The METAL SPECIALTY *Co.* PLASTIC DIVISION

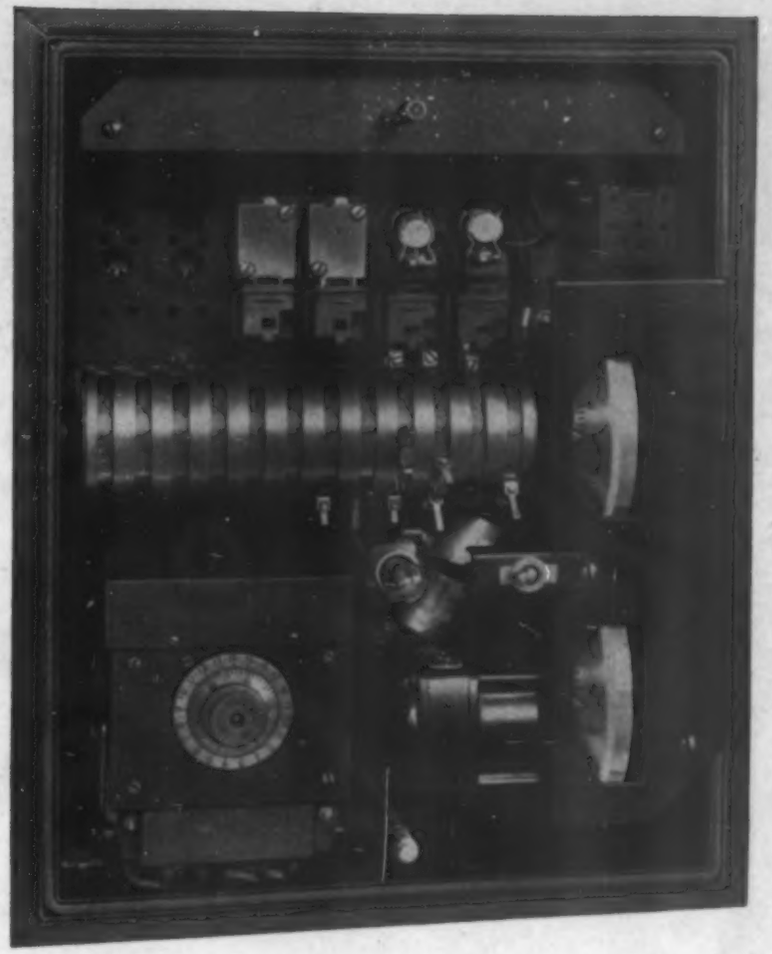
MAIN OFFICE AND PLANT • ESTE AVENUE • CINCINNATI, OHIO

Taylor presents

"WHEELS WITHIN WHEELS"

•

A TIMER WITHIN A TIMER— TO ENABLE YOU TO CHANGE ANY CURE PERIOD SIMPLY— WITHOUT COMPLICATED RE-SETTINGS



When it comes to automatic platen press operation, we thought our Taylor Flex-O-Timer was the last word in adaptability. But now our engineers have made it even more versatile.

What they've done is install a small auxiliary timing mechanism in the lower left corner of the Taylor Flex-O-Timer instrument case. The Flex-O-Timer initiates and terminates all necessary process functions, while the auxiliary timer times the cure period only. So when you want to change the cure period, you can do it with just one simple dial adjustment, without touching any of the settings on the Flex-O-Timer itself.

Simple, isn't it? It really *is* simple, and your Taylor Field Engineer is anxious to show you how it can help you improve quality and cut costs. All you do is load the press and push the button — Taylor Accuracy does the rest! Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow, and liquid level.

ARMY E NAVY

Taylor Instruments

MEAN

ACCURACY FIRST

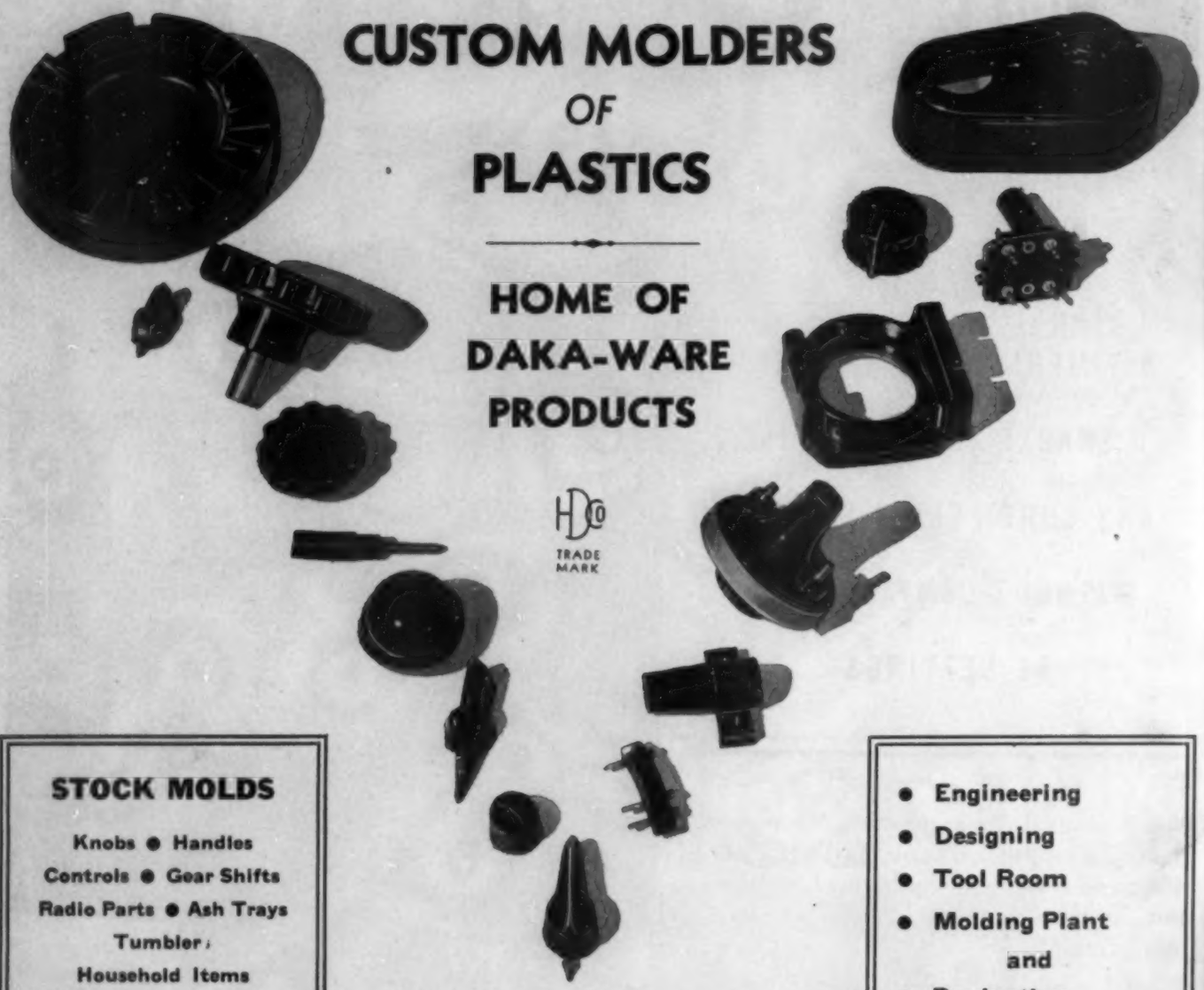
IN HOME AND INDUSTRY

KEEP ON BUYING U. S. WAR BONDS AND STAMPS

CUSTOM MOLDERS
OF
PLASTICS

HOME OF DAKA-WARE PRODUCTS

HDCo TRADE MARK



STOCK MOLDS

Knobs ● Handles
Controls ● Gear Shifts
Radio Parts ● Ash Trays
Tumblers
Household Items

Write for Illustrated Catalog

- Engineering
- Designing
- Tool Room
- Molding Plant and
- Production Facilities

BIDS INVITED

HARRY DAVIES MOLDING CO.

1428 N. Wells Street **Chicago, Illinois**

PLEXIGLAS

...and modern plane *PERFORMANCE*

TO the pilots of 1918 Jennys and Spads, a speed of 200 miles per hour was unthinkable. Men couldn't possibly breathe in such fast and freezing slipstreams, let alone pilot a plane or aim a gun.

But they didn't foresee PLEXIGLAS.

Today this crystal-clear plastic — formed into streamlined bomber noses, tail assemblies, gun turrets and cockpit canopies — protects the crew on every type of Army and Navy airplane.

Even in the extremely low temperatures of the sub-stratosphere PLEXIGLAS is strong and shatterproof. It is permanently transparent and will not discolor or warp in service. PLEXIGLAS is as clear as optical glass yet only half as heavy.

Recognized as "aviation's standard transparent plastic," PLEXIGLAS will also contribute to the comfort, safety, visibility and performance of your peacetime plane tomorrow.

Only Rohm & Haas makes Plexiglas

ARMY E NAVY

PLEXIGLAS *is the trade-mark, Reg. U.S. Pat. Off., for the acrylic resin thermoplastic sheets manufactured by the Rohm & Haas Company.*

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries

Experience Spotlights the *Simplest* Fastening Method

. . . guides E. A. Laboratories to Savings with P-K Self-tapping Screws

SPEED PLASTIC ASSEMBLIES

Inter-Aircraft Control Light

3 P-K Type "F" Screws used as locating pins for lamp unit.

4 P-K Type "F" Screws hold switch contactor and terminal lug in position.

5 P-K Type "F" Screws fasten Bakelite handle cover plate to Bakelite handle.

SPEED METAL ASSEMBLIES

Retractable Landing Lights

3 P-K Type "F" Screws driven through bakelite insulator, fasten electrical connector to lamp housing, both of die cast aluminum.

8 P-K Type "F" Screws fasten gear housing to lamp housing, both of die cast aluminum.

5 P-K Type "F" Screws fasten aluminum housing plate to die cast aluminum housing. Inside the lamp, P-K Type "F" Screws are used to fasten motor field to motor housing, and motor housing to gear housing.

E. A. Laboratories, Brooklyn, N. Y., having "questioned every fastening" on peacetime assemblies, were ready with the answer when heavy war orders made it necessary to pare production time and costs to the bone.

By designing their aircraft lighting specialties for assembly with P-K Self-tapping Screws, they eliminated tapping and tap maintenance, and the need for metal inserts in the plastic lamp. The P-K Type "F" Screws, cutting their own clean threads as they are driven, add to the strength and security so necessary in these products, and can be easily removed and replaced when required.

Take full advantage of Parker-Kalon's Assembly Engineering Service. Experience proves, in 7 out of 10 cases, P-K Self-tapping Screws will simplify plastic or metal fastening jobs . . . save vital man-hours . . . speed production . . . cut costs.

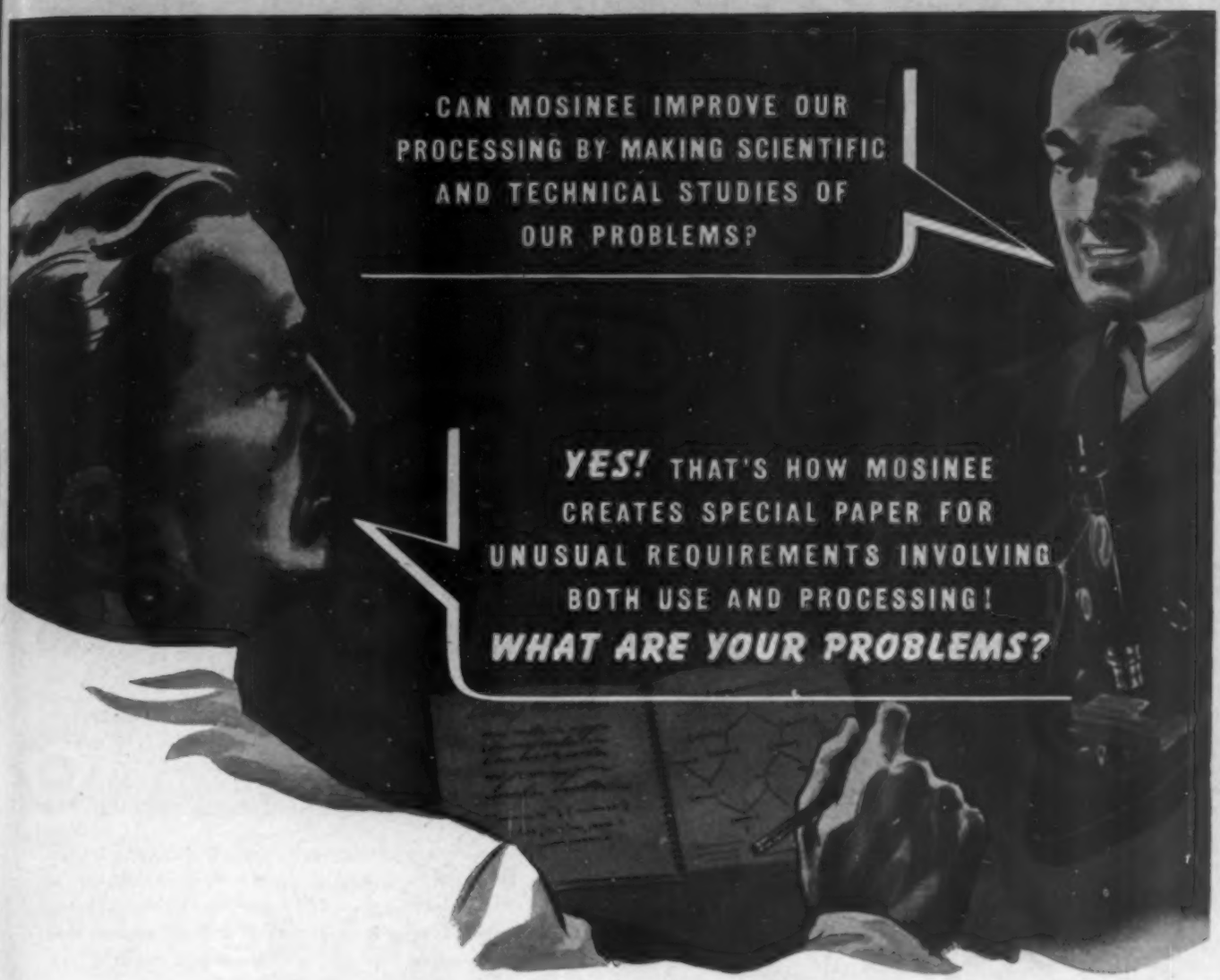
Question every fastening job . . . on the drafting board . . . in production. First see if it can be done with simple P-K Self-tapping Screws before putting up with slow, difficult fastening methods. Your request will bring a P-K Assembly Engineer to help you uncover opportunities to save time and money. Or, send details of your assembly for recommendations. Parker-Kalon Corp., 190-200D Varick Street, New York 14, N. Y.

SELF-TAPPING SCREWS FOR EVERY METAL AND PLASTIC ASSEMBLY

PARKER-KALON

Quality-Controlled

SELF-TAPPING SCREWS


CAN MOSINEE IMPROVE OUR PROCESSING BY MAKING SCIENTIFIC AND TECHNICAL STUDIES OF OUR PROBLEMS?
YES! THAT'S HOW MOSINEE CREATES SPECIAL PAPER FOR UNUSUAL REQUIREMENTS INVOLVING BOTH USE AND PROCESSING!
WHAT ARE YOUR PROBLEMS?

THESE CHARACTERISTICS WERE REQUIRED IN A PAPER
1 — High tensile strength; 2 — Excessive bulk; 3 — Accurate caliper; 4 — Pliability; 5 — Controlled absorption; 6 — High tear resistance.

- - and MOSINEE made it!

Have you considered how changes in certain physical properties of the paper you are using might improve your *processing* schedule, reduce production costs, and increase preference for your products?

Paper sometimes is the *obvious* cause of difficulties in processing. Mosinee engineers solve many difficult problems promptly. There are many instances, however, where no tangible "trouble" exposes itself, but where a thorough technical study of the paper and its relation to processing will result in higher speed production.

Whatever your situation may be, consultation with the Mills of Mosinee should bring practical answers.

MOSINEE PAPER MILLS CO. MOSINEE WISCONSIN

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. A"

Rich rewards in studying plastics

THE CURRICULUM INCLUDES ALL THESE

MOLDING—Study of Molding Materials and Flow Properties. Dependence of Properties of Materials Upon Methods of Molding.

MOLD DESIGN AND CONSTRUCTION—Fundamental Requirements of Thermosetting and Thermoplastic Composition in Molding.

CASTING—Materials Suited for Casting Purpose. Production Techniques Developed for Casting Phenolic Resins and Acrylic Resins.

LAMINATING—Procedure of Impregnating Fabrics, Paper, Asbestos and Wood.

TECHNIQUES OF FABRICATION—Thermoplastic Qualities of Plastic Materials.

TESTING—Why Plastics Differ from Other Materials of Construction and Wherein Test Methods Will Differ.

DESIGNING AND STYLING WITH PLASTICS

Historical Background. Polymerization Phenomena and the Formation of Plastics. Introduction to Organic Chemistry. Formation of Phenolic Plastics. Urea Resins and Their Characteristics. Polyvinyl Resins and Their Characteristics. Acrylic and Polystyrene Resins. Cellulose Plastics — Origin and Chemistry. Introduction to Cellulose Chemistry. Utilization of Farm Products and Waste Materials in Plastics. Synthetic Rubbers and Rubber-Like Materials. Electrical Properties of Plastic Materials. Chemical Properties of Plastic Materials. Optical Properties of Plastics. Styling and Art in Plastics.

★

NO pleasure driving—no bright lights downtown—you'll be home a lot this year, especially in the evenings. Instead of the monotony of extra time at home, lots of farsighted folks are making spare time hours pay dividends. They're investing evening hours in a plastics education—preparing for the future when *more* technical knowledge of plastics will be important to their career in this field.

The unusual Home Study plan of Plastics Institute is specially prepared to give you a practical education in plastics. A series of fully illustrated lessons parade the whole plastics world across your desk—included are 29 samples of plastics—you learn about materials—their applications, properties and limitations—methods of molding, laminating, fabricating and casting—design—testing—all the fundamental information of the complete engineering course. You also receive Plastics Trends, a fast moving publication on the new in Plastics.

Whether you are now in plastics or plan to enter this growing field—it will pay you to get complete information on the Plastics Institute Home Study lesson assignments. Write today for the new Booklet on "Rich Rewards in Plastics".

Plastics
INDUSTRIES TECHNICAL INSTITUTE

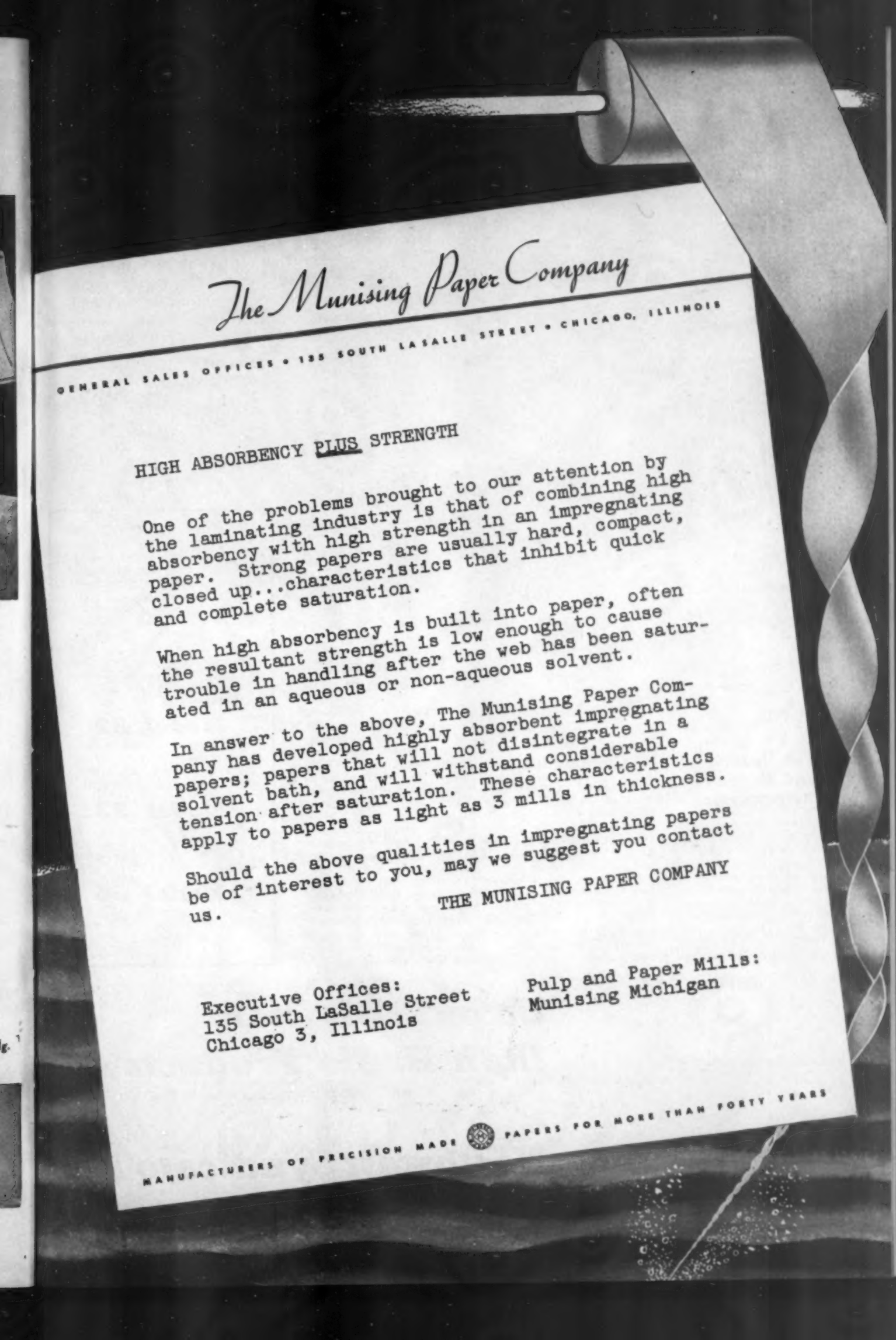
NEW YORK	LOS ANGELES	CHICAGO
1220-A Chanin Bldg.	182 S. Alvarado St.	626-A La Salle-Wacker Bldg.
Dept. 11	Dept. 11	Dept. 11

AMERICA'S ORIGINAL PLASTICS SCHOOLS

Francis A. Gudger, President
John Delmonte, Technical Director

ADVISORY BOARD
E. F. Lougee, Chairman

Donald Dew, Diemolding Corporation
Dr. Gordon M. Kline, National Bureau of Standards
Spencer E. Palmer, Tennessee Eastman Corp.
Louis M. Rossi, Bakelite Corporation



The Munising Paper Company

GENERAL SALES OFFICES • 135 SOUTH LA SALLE STREET • CHICAGO, ILLINOIS

HIGH ABSORBENCY PLUS STRENGTH

One of the problems brought to our attention by the laminating industry is that of combining high absorbency with high strength in an impregnating paper. Strong papers are usually hard, compact, closed up...characteristics that inhibit quick and complete saturation.

When high absorbency is built into paper, often the resultant strength is low enough to cause trouble in handling after the web has been saturated in an aqueous or non-aqueous solvent.

In answer to the above, The Munising Paper Company has developed highly absorbent impregnating papers; papers that will not disintegrate in a solvent bath, and will withstand considerable tension after saturation. These characteristics apply to papers as light as 3 mills in thickness.

Should the above qualities in impregnating papers be of interest to you, may we suggest you contact us.

THE MUNISING PAPER COMPANY

Executive Offices:
135 South LaSalle Street
Chicago 3, Illinois

Pulp and Paper Mills:
Munising Michigan

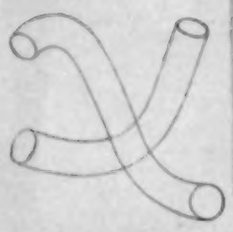
MANUFACTURERS OF PRECISION MADE PAPERS FOR MORE THAN FORTY YEARS

Let Electronics Increase *Your* Production

Operators in both thermosetting and thermoplastic fields experience amazing production gains through use of UTRONIC rf heating units. Our research engineers are ready to help solve your problems through application of the new M&R System of RF generation. Write for booklet and prices on the UTRONIC rf GENERATOR.

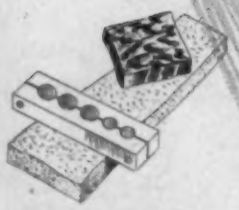
Intertherm* Reaction

*Means Greatest Heat in the Center.
Copyrighted 1943,
Northwest Syndicate, Inc.



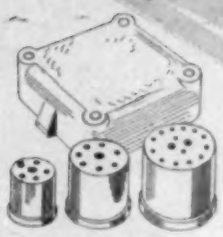
For Heating and Shaping Thermoplastics

Heat and bend plastic tubing by the M&R System in only two minutes. Form compound curves and odd shapes of sheet material in amazingly short time cycles. Produce molded, stamped and pressed thermoplastic parts FASTER with the UTRONIC rf GENERATOR'S internal preheating.



For Rubber Compounds

Hundreds of new applications of the M&R System are possible in the preheating of neoprene cork compounds, in treating natural rubber, in curing and preheating rubber compounds, in curing resin-bonded grinding wheels. The UTRONIC rf GENERATOR allows a control over heat *placement*—a distinct operational advantage.



For Thermosetting Moldings

Preheating by "Intertherm Reaction" opens new vistas of business for thermosetting molders. Greatest heat is directed to the CENTER of the preform, resulting in fast, final flow characteristics . . . larger moldings on same press capacity . . . lower temperatures . . . fewer rejects. Actual experience shows double the productive output on small preforms, over three times the output on larger preforms. Our newly developed automatic electrodes eliminate changing and re-spacing electrode elements on different size preforms.

Models 22, 33 and 66 UTRONIC rf GENERATORS are compact and portable . . . each weigh less than 200 pounds . . . occupy only 20 x 30 inches of table space . . . operate from single-phase, 60-cycle 220 volt AC lines. Complete units, ready to install in your plant: fast delivery on highest priorities. Larger models available. All units subject to sale or lease arrangement.

Model 22

For laboratory research and for preforms under 5 ounces. Output work rate: 2200 BTUs per hour in the work.

Model 33

For preforms up to 12 ounces. Output work rate: 3300 BTUs per hour in the work.

Model 66

For preforms up to 20 ounces. Output work rate: 6600 BTUs per hour in the work.

UTILIZING THE

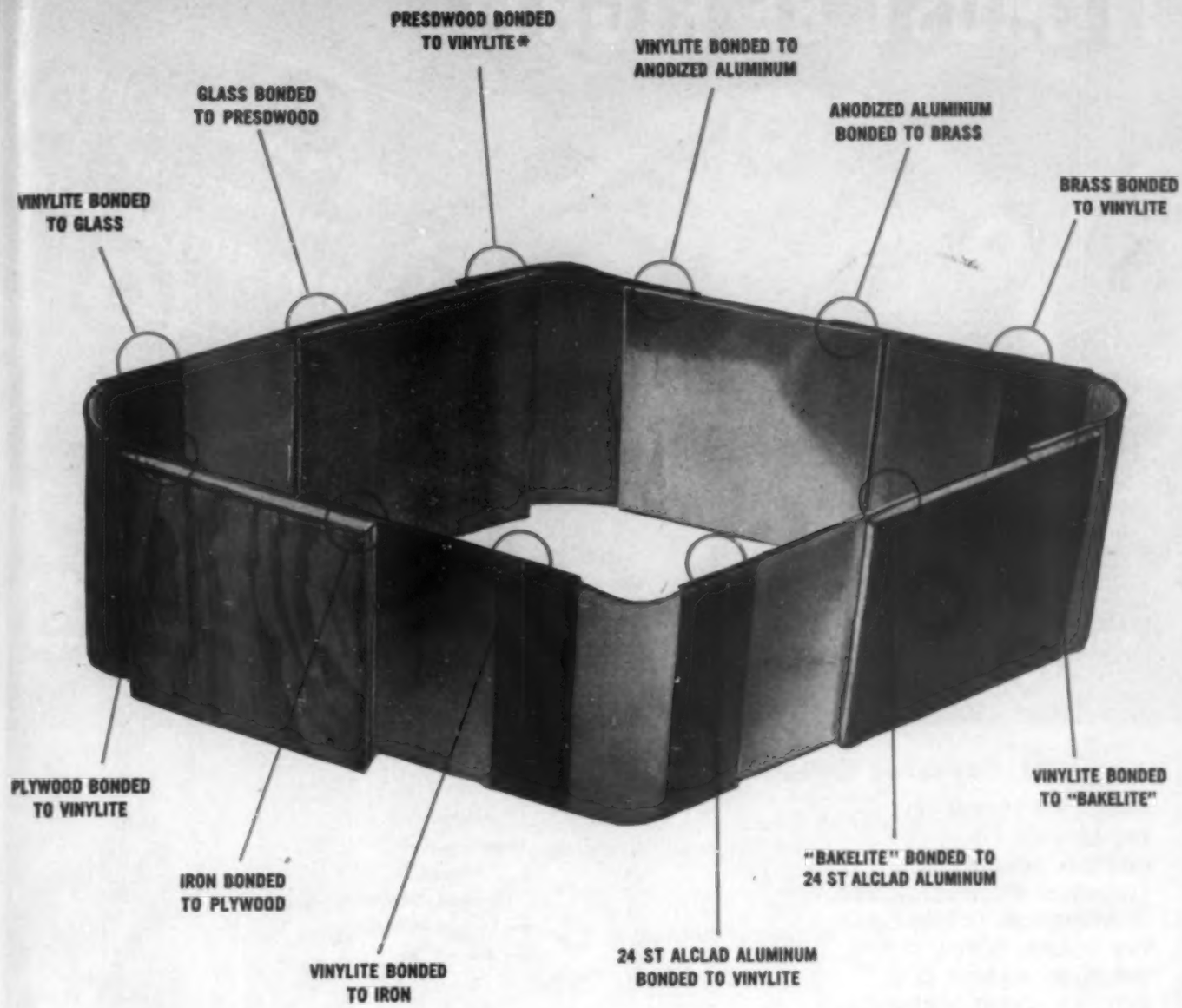
Utronic Division
Utah Radio Products Co.

★ *820 Orleans Street, Chicago 10, Illinois*

In the West:

Northwest Syndicate Inc.

★ *711 St. Helens Ave., Tacoma 1, Washington*


PRESDWOOD BONDED TO VINYLITE*
VINYLITE BONDED TO ANODIZED ALUMINUM
GLASS BONDED TO PRESDWOOD
ANODIZED ALUMINUM BONDED TO BRASS
VINYLITE BONDED TO GLASS
BRASS BONDED TO VINYLITE
PLYWOOD BONDED TO VINYLITE
VINYLITE BONDED TO "BAKELITE"
IRON BONDED TO PLYWOOD
"BAKELITE" BONDED TO 24 ST ALCLAD ALUMINUM
VINYLITE BONDED TO IRON
24 ST ALCLAD ALUMINUM BONDED TO VINYLITE

Perfect Bonds with CORDO Adhesives

Shown here in a laboratory working model are typical bonds established with CORDO adhesives. Many of these combinations are now in commercial use.

Bonding strength approaches, and, in some combinations, equals or exceeds the strength of the materials being bonded.

Perhaps one or more of the above bonds can answer your problems. If not, our research laboratory facilities are available. Please give full details of materials involved and all possible methods of application.

* * *

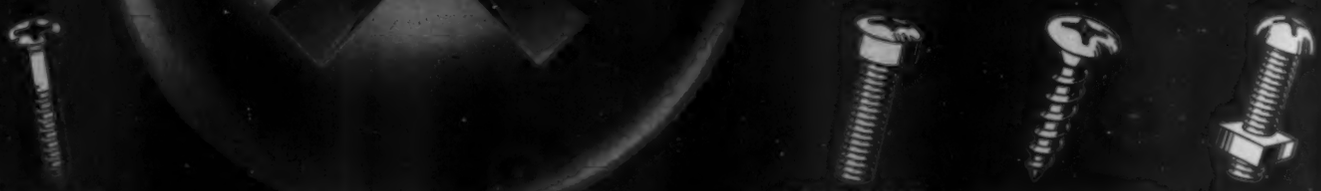
* VINYLITE is the registered trade mark of CARBIDE AND CARBON CHEMICALS CORPORATION.

CORROSION CONTROL CORPORATION
(AFTER JANUARY 1, 1944—CORDO CHEMICAL CORPORATION)
34 Smith Street, Norwalk, Connecticut
INDUSTRIAL COATINGS • FINISHES • LACQUERS • ADHESIVES

CORDO

IT MUST BE RIGHT!

21 Leading Makers of Screws recommend the PHILLIPS RECESSED HEAD



WOOD MACHINE SELF-TAPPING STOVE

21 Concerns Offer the Phillips Head

AMERICAN SCREW CO.	Providence, R. I.
THE BRISTOL CO.	Waterbury, Conn.
CENTRAL SCREW CO.	Chicago, Ill.
CHANDLER PRODUCTS CORP.	Cleveland, Ohio
CONTINENTAL SCREW CO.	New Bedford, Mass.
THE CORBIN SCREW CORP.	New Britain, Conn.
THE H. M. HARPER CO.	Chicago, Ill.
INTERNATIONAL SCREW CO.	Detroit, Mich.
THE LAMSON & SESSIONS CO.	Cleveland, Ohio
THE NATIONAL SCREW & MFG. CO.	Cleveland, Ohio
NEW ENGLAND SCREW CO.	Keene, N. H.
THE CHARLES PARKER CO.	Meriden, Conn.
PARKER-KALON CORP.	New York, N. Y.
PAWTUCKET SCREW CO.	Pawtucket, R. I.
PHEOLL MANUFACTURING CO.	Chicago, Ill.
READING SCREW CO.	Norristown, Pa.
RUSSELL BURDSALL & WARD BOLT & NUT CO.	Port Chester, N. Y.
SCOVILL MANUFACTURING CO.	Waterville, Conn.
SHAKEPROOF INC.	Chicago, Ill.
THE SOUTHINGTON HARDWARE MFG. CO.	Southington, Conn.
WHITNEY SCREW CORP.	Nashua, N. H.

Out of the many screw heads designed through the years to eliminate screw driving troubles, *only* ONE has gained wide approval by the men who should know most about screws... the men who develop and produce fastening devices.

It is highly significant that the leaders in the screw industry . . . *21 concerns* . . . recommend the PHILLIPS RECESSED HEAD as the first recessed head that is *right* in every respect! It assures you that screw driving troubles will be ended when you specify PHILLIPS. Also, it means convenience in buying, and prompt and capable service.

PHILLIPS *Recessed Head* SCREWS

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

for Dependability!

DURITE

Reg. U. S. Pat. Off.

Plastics of Outstanding Quality to Meet Today's Production Needs

RESINS * * *

Phenol-Formaldehyde and Phenol-Furfural synthetic resins for every purpose

MOLDING COMPOUNDS * * *

Complete line of Phenol-Formaldehyde and Phenol-Furfural molding powders

CEMENTS * * *

Used universally in the manufacture of incandescent lamps, radio tubes and electronic equipment

ADHESIVES * * *

Plywood . . . for hot and cold press bonding

OIL SOLUBLE RESINS * * *

For production of air-drying or baking varnishes, protective coatings and finishes

WATER SOLUBLE RESINS * * *

For a wide variety of impregnating, coating and bonding applications

*PLUS! . . . DURITE RESEARCH * * **

The DURITE laboratories are among the most modern and best equipped in the country, and have won a national reputation for research and development in plastics. You are invited to refer any of your plastic problems to our engineers.

DURITE PLASTICS

INCORPORATED

FRANKFORD STATION P. O. PHILADELPHIA 24, PA.

★

SYNTHETIC RUBBER COMPOUNDS • PHENOL-FURFURAL PRODUCTS • PHENOL FORMALDEHYDE PRODUCTS

NORTON LABORATORIES
(INCORPORATED)
CUSTOM MOULDERS OF SYNTHETIC PLASTICS
BAKELITE DUREZ
LOCKPORT, N.Y.

NORLOC NOVELTIES

ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, FIRES, ACCIDENTS OR CAUSES BEYOND OUR CONTROL. CONTRACTS WITH AGENTS NOT VALID UNTIL APPROVED BY AN OFFICER

November, 1943

Dear Friends:-

I see the Plastic Industry in $ and ¢ signs. To me, it looks good. Of course, we aren't salting any millions away in the old sock, but at least we are able to keep the heel and toe neatly mended.

It's interesting to note the many fine customers we have and how we seem to have the little part of synthetic plastic that fits into the puzzle to make their picture complete.

Could we help you with your problems? Of course, we're definitely on a priority basis now, but after the war we feel sure that there will be a lot of new people that we will want to meet and that will want to meet us.

Our people here have gone all out for War Bonds, and know yours have too.

We must keep on "Backing the Attack".

Sincerely,

W. H. Hoenig
Treasurer

64652-RT-Comp. -10-19

WANTED "DEAD" or ALIVE!

Don't let an old mold stay in hiding because you think it is "dead"! . . . Report it in to Industrial Hard Chromium headquarters. Put us on its trail. We've a way of tackling the problem that will well reward you. We can restretch a "dead" mold's life span over a good many more extra hours of flawless performance!

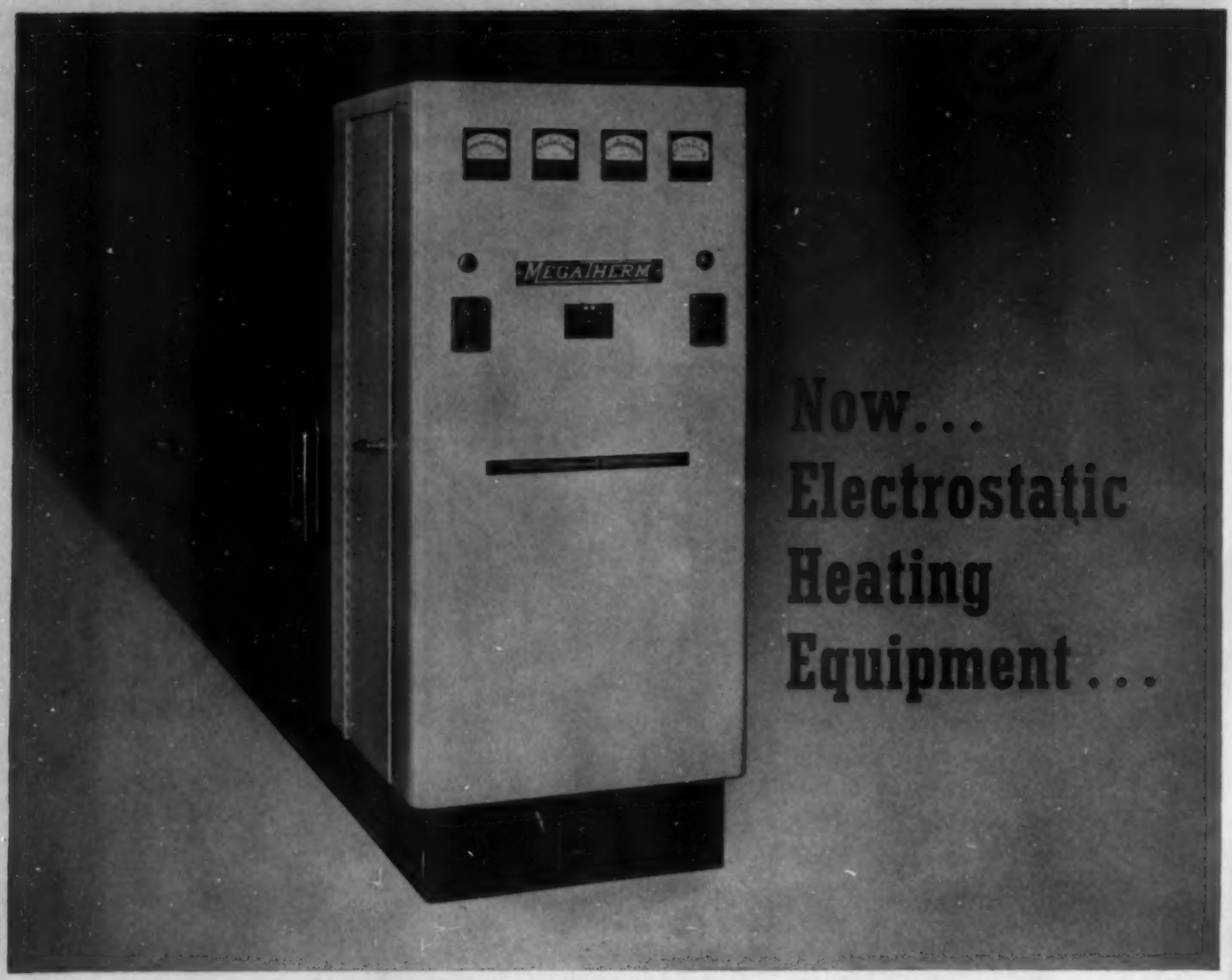
It doesn't make any difference whether the "old fellow" was previously plated or not. If unplated, then a carefully applied plating will restore life. If originally plated, we can strip the worn shell—replace it—build up strained sections — reach into the most intricate cavities—and meet "like new" specifications.

What goes for an old mold—applies, as well to live ones . . . and new ones. By starting them off with a protecting shell of Industrial Hard Chromium, you will have no further reason for an eventual "dead" storage shelf. Because of this and other Industrial Hard Chromium advantages, we invite your inquiry.

INDUSTRIAL HARD CHROMIUM CO.

"Armorplate for Industry"

15 ROME STREET • NEWARK 5, NEW JERSEY



Now... Electrostatic Heating Equipment...

...Designed and Built to the Special Requirements of the Plastics Industry

RUGGED
Stands Hard Usage; ⅛" Steel Cabinet

RELIABLE
Gives Efficient, Dependable Service

PORTABLE
Easily Moved for Any Application

COMPACT
All-in-one Unit Saves Floor Space

SIMPLE
Strictly Non-technical in Operation

SPEEDY
Increases Production

ECONOMICAL
Reduces Heating Time and Die Costs

SAFE
Complete Protection for Operator

In pioneering megacycle radio energy for industrial use, Federal has developed an application for Plastics processing that is unique both in conception and performance.

Through its Megatherm equipment it has put radio frequency heating on a practical basis, which assures perfect molding at low pressures, prevents breakage of die inserts, reduces curing time from minutes to seconds and provides uniformity, speed and economy.

Constructed along the same lines as any other machine tool, Megatherm equipment is installed without change in plant layout. It is ready for operation — merely has to be set alongside press and started to work for double or triple production. Simplicity of the unit eliminates tuning or other adjustment. It is controlled by two push buttons, with foot switch optional, and can be operated by unskilled, untrained help.

Megatherm will give you greater production at less cost.

We shall be glad to discuss it with you in terms of your requirements.

-MEGATHERM-

Federal Telephone and Radio Corporation

INDUSTRIAL ELECTRONICS PRODUCT DIVISION, Newark, New Jersey

AN IT&T ASSOCIATE

NOW IN OUR *New* QUARTERS

SO WE MAY SERVE YOU *Better!*

So we may serve you better, we have moved to larger quarters to enable our various departments to function with greater efficiency. At the present time our operations are devoted to production for wartime uses, but we hope to be able to turn our efforts entirely to the creation and production of thermoplastics for a world at peace. Our engineering and creative staff will be glad to assist you with any war or post-war problems and to give you the benefit of our experience in the most recent developments in molding and extruding materials.

ELMER E. MILLS CORPORATION

Molders of Tenite, Lumarith, Plastacele, Fibestos, Lucite, Crystallite Polystyrene, Styron, Lustron, Loalin, Vinylite, Mills-Plastic, Saran and Other Thermoplastic Materials

153 WEST HURON STREET, CHICAGO 10, ILLINOIS

Write on your letterhead for the Injection Molded and Extruded Plastics Catalog III. Also available is a new six-page circular on MILLS-PLASTIC* tubing and fittings. *Made of Saran.

LINCOLN CENTRO-MATIC LUBRICATING SYSTEMS

cut down on bearing failures --and prevent delays in war production

These modern centralized lubricating systems are easily installed on new or old machines

Lubricate *all* bearings from a central source . . . Reduce the threat of bearing failures . . . Save man-hours . . . It's possible with Centro-Matic Systems.

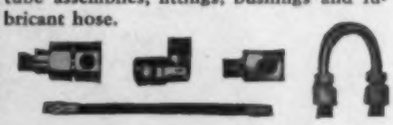
Under the Lincoln method you are sure that each bearing will get the proper amount of grease, and that no bearings will be overlooked. Service is performed quickly and economically—without stopping machines.

A Centro-Matic System consists of a number of Centro-Matic Injectors—one for each bearing—and a power operated or a hand operated Centro-Matic Lubricant Pump. A power operated system can be push button or time clock control...Only a single lubricant supply line is required...Easily installed on new or old machines. (Illustration above shows manually operated Lincoln Centro-Matic Lubricating System installed on a punch press).

Lincoln Model 1774 Air motor operated, 400-lb. drum pump. Pumps lubricant direct from original refinery container and is full automatic with time clock control.

Lincoln Centro-Matic injectors can be used either in manifold groupings or as single units depending upon the requirement.

Lincoln grease line accessories—high-pressure fittings and adapters, connectors, connector tube assemblies, fittings, bushings and lubricant hose.



Lincoln Model 1805, Manually operated Centro-Matic Pump, 2-lb. capacity.

Model 81625 hand operated Filler Pump provides a quick, clean, easy and economical method of filling Centro-Matic Stationary Lubricant pumps.

The ARMY-NAVY PRODUCTION AWARD for high achievement in the production of war equipment, conferred upon the Lincoln Engineering Company has had a star added. This star symbolizes 6 more months of exacting service to our Armed Forces, delivering vital materials so necessary for ultimate Victory.

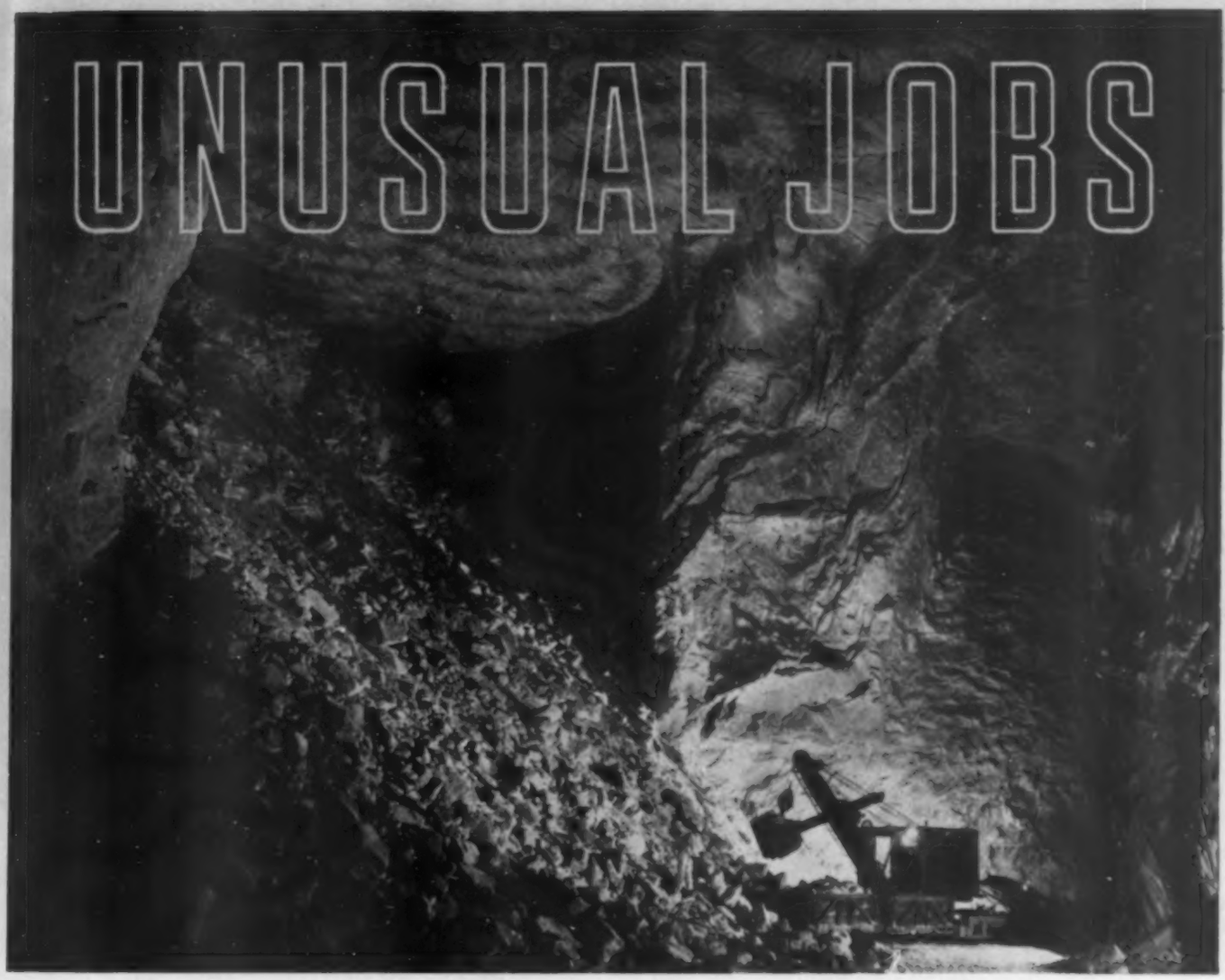
Write us today for complete information 143-47

LINCOLN ENGINEERING COMPANY

Pioneer Builders of Engineered Lubricating Equipment

ST. LOUIS, MO., U. S. A.

UNUSUAL JOBS



Among unusual jobs is that of the steam shovel operator working deep below the earth's surface in an enormous salt mine. Photo courtesy International Salt Company, Inc.

SINKO has many unusual and highly intricate peacetime jobs to its credit. And the vital war work which currently taxes our facilities to the limit, is even more precise and amazingly unique than ever. These versatile plastics engineers of ours have gained an enviable reputation for mastering the impossible in many injection molding operations. Our success has been extraordinary in producing formerly unheard of applications of metal reinforced thermoplastics. While war production proceeds at terrific pace, we're never too busy to lend you every possible aid in your post-war thinking and planning. Discuss your ideas and problems with our nearest representative or write us today!

Sinko

PRECISION INJECTION MOLDING

SINKO TOOL & MANUFACTURING COMPANY, 351 NO. CRAWFORD AVENUE, CHICAGO, ILLINOIS

REPRESENTATIVES: L. D. MOORE, 4030 CHOUTEAU AVE., ST. LOUIS, MO. • POTTER & DUGAN, INC., 29 WILKESON ST., BUFFALO, N.Y. • ARCH MASON, 259 CENTRAL AVE., ROCHESTER, N.Y. H. O. ANDERSON, 202 HERALD BLDG., SYRACUSE, N.Y. • PAUL SEILER, 7779 CORTLAND AVE., DETROIT, MICH. • QUEISSER BROS., 108 EAST NINTH ST., INDIANAPOLIS, IND.

Coated Abrasives And Service

There is no type of coated abrasive, patented or unpatented, for use dry or wet, that we do not manufacture; no shape that we do not produce. *Anything* in modern "sandpaper" is ready for your use.

But that is not enough. In these days of continual invention, and changing techniques and improvements, our Field Engineers are in daily touch with plants of all kinds and sizes, with all types of new and unusual sanding and finishing problems. It's part of our plan and their job—a very important part—to see that users get the one best abrasive material for every operation and the last ounce of value from our recommendations.

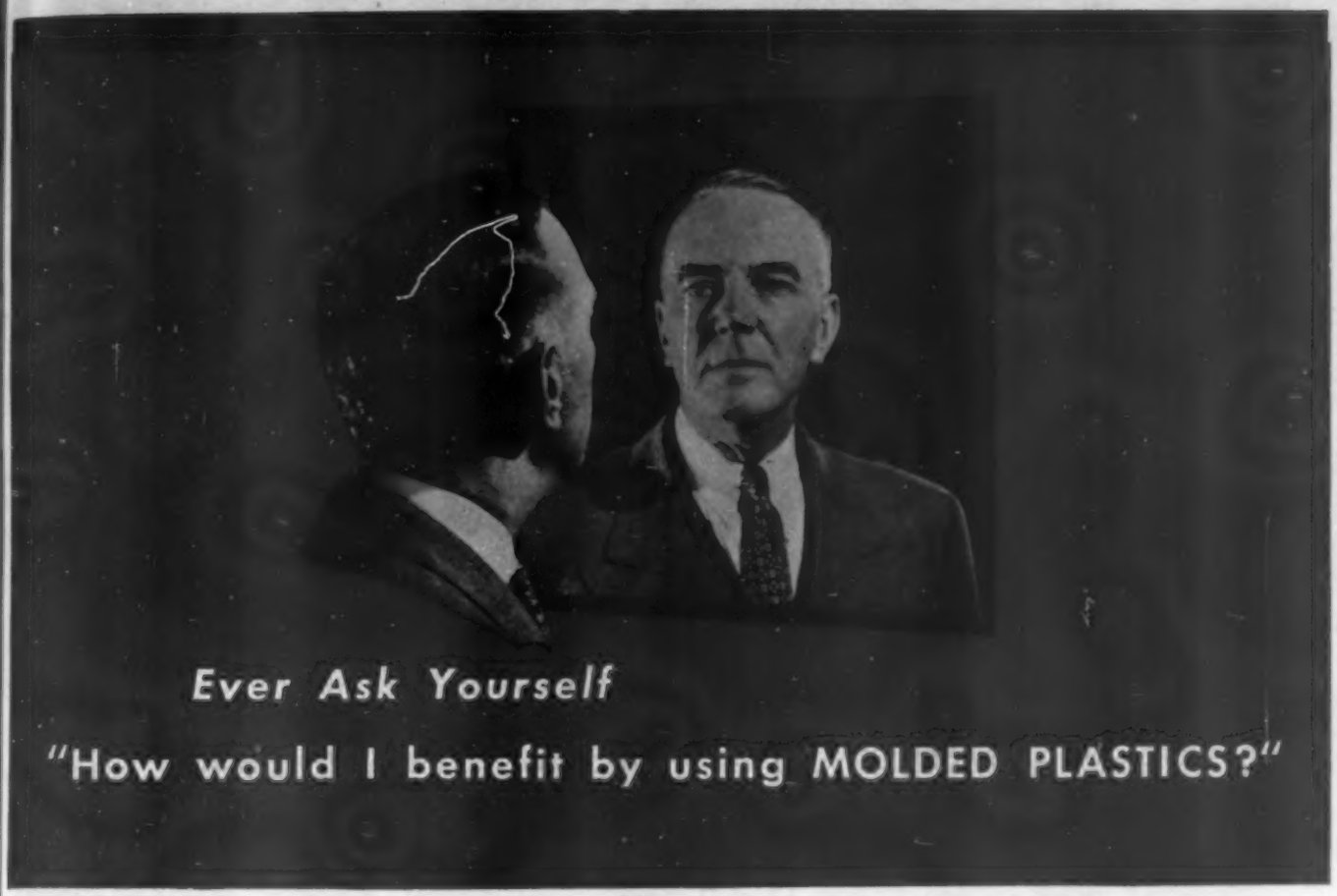
If you have any sanding or finishing operations, let us check them with you. A postal or phone call to Troy or our nearest Branch will have prompt personal attention.

Pioneers in Better Coated Abrasives Since 1872

BEHR-MANNING
(DIVISION OF NORTON COMPANY)
TROY, N. Y.

QUALITY ABRASIVES
NORTON ABRASIVES

BRANCHES: Boston, Buffalo, Chicago, Cleveland, Cincinnati, Grand Rapids, High Point, Indianapolis, Detroit, Los Angeles, New York, San Francisco, Philadelphia, St. Louis, Tacoma.



Maybe you wouldn't. Molded plastic parts aren't all things to all products by any means. With all their versatility there are things they cannot do as well as other materials.

But they are finding new and sometimes startling uses every day. The tonnage of plastic materials for molding has increased more than 500% in the last six years.

But probably there IS an answer to the question, for molded plastics have very clearly defined characteristics. They can be dense, hard, soft, light, tough, brittle, dull, thick, thin, transparent, opaque, translucent; they can be noninflammable, resistant to abrasion; they can have dielectric properties; they can give you all the colors of the spectrum.

It is likely that we can help answer your question. We've been turning out molded plastic parts and products by the millions of pounds and pieces, in thousands of different shapes and sizes, using dozens of different plastic materials and hundreds of presses of various kinds and sizes.

If you will tell us what you want molded plastics to do, we can probably tell you whether they are a good, bad or indifferent bet for your purpose. And we'll tell it to you STRAIGHT, too. We've no more taste for disappointments than you have.

So—if you have ever asked yourself, "How would I benefit by using molded plastics?"—we'll be glad to answer you frankly or tell you we don't know. Maybe that would help advance your postwar planning.

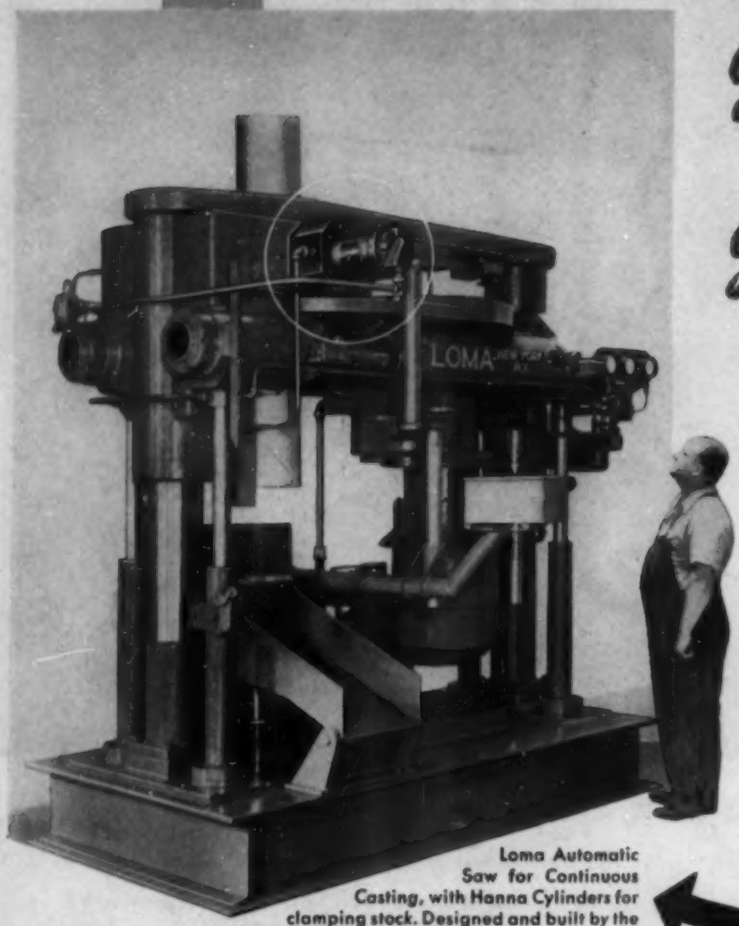
THE GENERAL INDUSTRIES COMPANY

MOLDED PLASTICS

Molded Plastics Division • Elyria, Ohio

Chicago: Phone Central 8431
Detroit: Phone Madison 2146
Milwaukee: Phone Daly 4057
Philadelphia: Phone Camden 2215

Hanna AIR and HYDRAULIC Cylinders



Loma Automatic Saw for Continuous Casting, with Hanna Cylinders for clamping stock. Designed and built by the Loma Machine Mfg. Co., Inc., New York City

Simple, Compact DESIGN

Smooth, Dependable POWER

. . . two reasons why Standard Models do Special Jobs Like this . . .

STANDARD Hanna Hydraulic Cylinders on the Loma Automatic Saw for Continuous Casting (shown above) supply the powerful thrust which clamps the stock in place while the saw is in action. Note how the smooth contours of the Hanna Cylinder blends with the machine's design. A minimum in overall dimensions, the absence of tierods and simple design make these Standard Hanna Cylinders appear to be "tailored" to the job.

The application of Hanna Cylinders in the Loma Saw is just one of 1001 Hanna Cylinder applications. Wherever a pushing, pulling, lifting, pressing or clamping action is needed, you can select a Hanna Cylinder to meet practically all requirements of size, power, length of piston stroke and mounting—with simplicity of design that makes them ideal for modern machines.

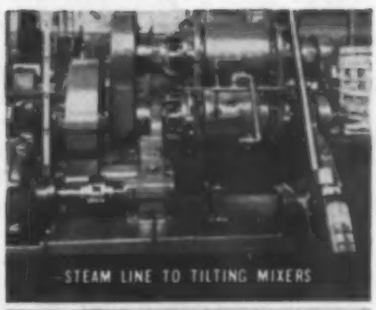
The rugged construction of Hanna Cylinders insures long life and freedom from maintenance problems. They will operate with air, oil or water—under pressures from 100 to 1500 lbs.

Investigate the advantages of using Hanna Cylinders in the machines and equipment which you design and build. What are your power movement problems? A Hanna engineer will gladly go over them with you.

● Send for these catalogs—
230: Hanna Air Cylinders
233: Hanna Hydraulic Cylinders.
They give you complete details.

HANNA ENGINEERING WORKS
1765 ELSTON AVENUE • CHICAGO 22, ILLINOIS
AIR & HYDRAULIC CYLINDERS • RIVETERS • AIR HOISTS

Bring your flexible joint problems to BARCO


STEAM LINE TO TILTING MIXERS

OIL DOCK UNLOADING LINES

Flexible Ball Joints • Swivel Joints • Revolving Joints

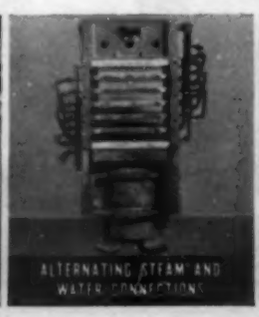
Write to Engineering–Sales Department

BARCO MANUFACTURING COMPANY
NOT INC.

1801 W. Winnemac Ave.
Chicago 40, Illinois

In Canada, The Holden Co., Ltd.
Montreal, Canada

FLEXIBILITY ON OSSFIN LINES


ALTERNATING STEAM AND WATER CONNECTIONS

FLEXIBILITY IN MUD PUMP LINES

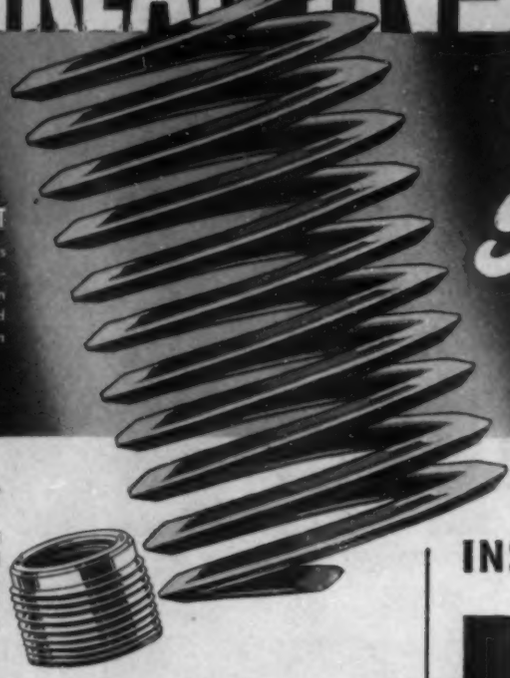
WATER BAG CONNECTIONS—DUAL TIRE PRESS

"Heli-Coil" SCREW THREAD INSERTS

SAVINGS PLUS!

THE NEW WIRE INSERT

The "Heli-Coil" Bushing of stainless steel or phosphor bronze wire engages screw threads of the American National System. Protects tapped threads in plastics against abrasion and damage.



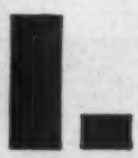
THE OLD HEAVY BUSHING The solid screw bushing is heavy and bulky. It, therefore, tends to restrict design. Internal and external threads are sometimes not concentric.

WITH the advent of the new "Heli-Coil" Screw Thread Insert, plastics manufacturers find a practical solution to the problems involved in threaded fastenings. This anti-friction thread lining is installed with simple hand or power tools much faster than solid screw bushings. Work can be tapped without need for accurate locating brass plugs in molds where tapping is done after molding to insure alignment of finished tapped threads. "Heli-Coil" Wire Inserts automatically provide accurately aligned bushings with tapped holes. "Heli-Coil" Inserts may also be molded in, requiring no bonding material.

Because it is much lighter and smaller than the conventional bushing, the "Heli-Coil" Screw Thread Insert permits radical simplification of design — resulting in stronger, lighter products. It cuts manufacturing costs, too, giving the user an important "edge" in post-war competition.

Complete engineering information supplied on request.

WITH "Heli-Coil" INSERTS YOU SAVE . .



TIME

Can be installed with simple hand or power tools in one-fourth the time required for solid screw bushings.

WEIGHT

Weighs one-fifth as much as the screw bushing of the same diameter.

SPACE

Occupies less than half as much cross sectional area as solid bushing, permitting more latitude in design.

METAL

Made from precision-shaped wire with no waste, requires about one-tenth as much metal as solid bushing made from bar stock.

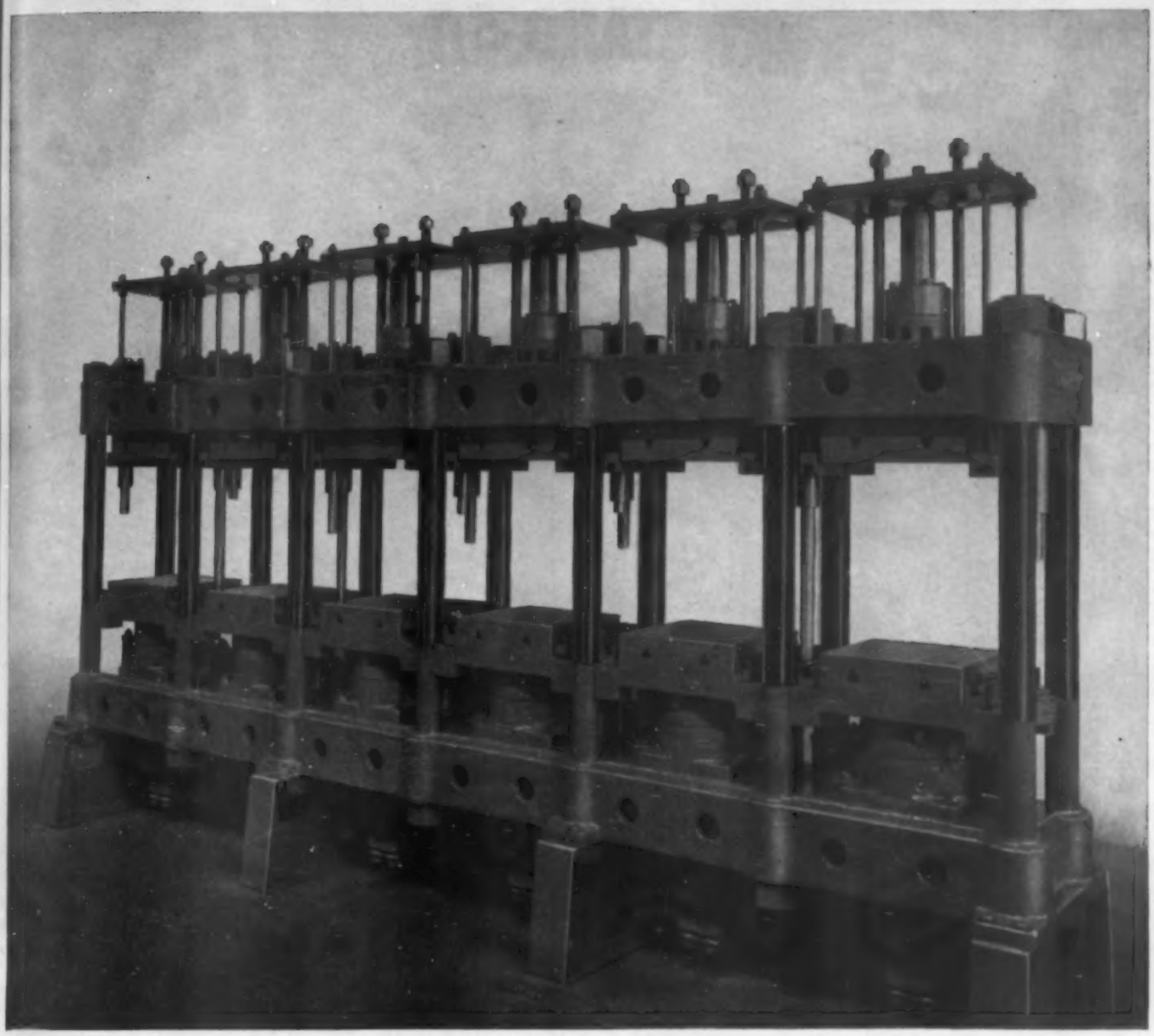
THE SCREW SYSTEM WITH THE ANTI-FRICTION THREAD LINING.

U. S. and Foreign Patents Issued and Pending.

AERO-THREAD

AIRCRAFT SCREW PRODUCTS COMPANY, INC.

47-23 35th STREET • LONG ISLAND CITY, 1, N.Y.



MULTIPLE MOLDING

Wherever you are or whatever you're doing —production is the word of the day. To get real production you need real equipment. This multiple molding press is so arranged that one press operator can handle the production output of 6 presses. If you have a production problem—call in our Southwark specialists, we make it our business to help you.

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco.

BLW THE BALDWIN GROUP

BALDWIN
SOUTHWARK
HYDRAULIC PRESSES

PRODUCTS THAT STAND OUT . . . SELL OUT

The colorful Don Juan lipstick containers illustrated are decorated with little Decal figures of soldiers, sailors, etc., for the patriotic girl. A product of Don Juan, Inc., 67 Vestry St., New York.

DECORATE PLASTICS WITH

MEYERCORD DECALS

Meyercord Decorative Decals are the ideal way to add colorful or interesting design to plain plastic surfaces . . . whether for package or product use. They are durable, washable, easily applied and economical to use. Special solutions insure perfect adhesion to various types of resin material. For the manufacturer still in consumer production, reasonable quantities of designs are now available. For the post-war planner, Meyercord's Decal experts offer technical counsel and designing service for future products. Inquiries are invited regarding the decoration of any type of plastic ware. Address all inquiries to Department 2111.

Consider Meyercord Decals for product decorations as well as package decoration. Amazing durability and adhesions of Meyercord Decals makes colorful decoration possible on the plastic ware illustrated above. They possess high washability, and resistance to hard use and wear. Remember . . . if your product ***stands out . . . it sells out.***

THE MEYERCORD CO.

World's Leading Decalcomania Manufacturer

5323 WEST LAKE STREET • CHICAGO 44, ILLINOIS

"Naturally.. FOR THE REALLY TOUGH MOLDING JOB . . . the LESTER was used"

Outer halves of this overnight kit are molded in one die. Inside lids, forming checker board and cribbage board, are also formed in one die. These parts are produced of Lumarith X on a 12-ounce Lester Injection Molding Machine.

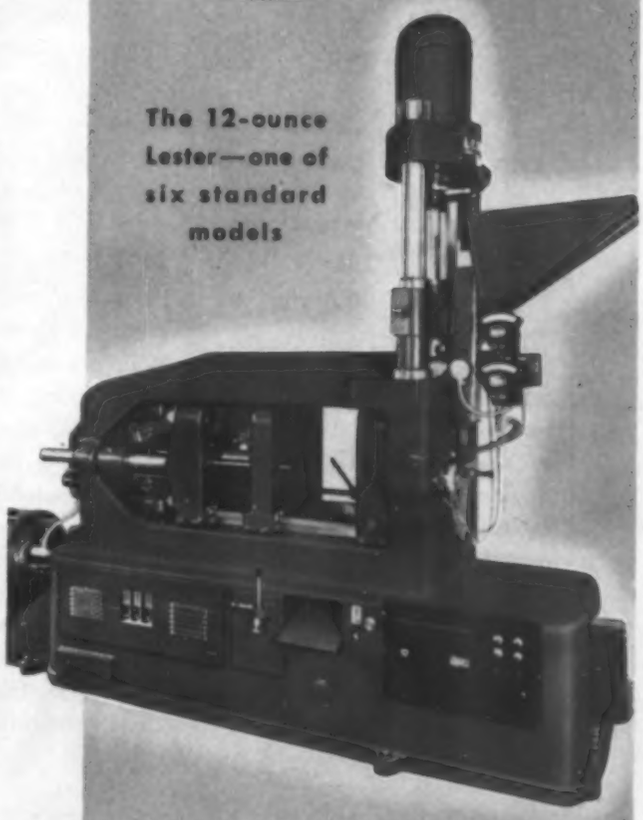
One of the most popular gifts for service men this year is the smartly styled, all-plastic overnight kit molded for "42" Products, Inc., by Plastic Die and Tool Corporation, Los Angeles, Calif. Contained in a compact pocket case, the kit includes smokers' aids and sewing equipment.

In describing the production plan for this custom molding job, Plastic Die and Tool Corporation said, "Naturally, on the smaller pieces we made use of our other equipment, but *for the really tough molding job,* that of making the boxes and lids, *the Lester was used.*"

Handling the tough jobs is nothing new for Lester Injection Molding Machines because they are engineered and built for sustained high production of superior quality moldings. Molders have come to rely upon the Lester for difficult jobs because in no other molding machine can be found the exclusive Lester features* of design and construction.

Because of their inherent high versatility, the Lesters which have been busy swelling the flow of plastic war products will be ready for instant conversion to profitable peacetime production when the day of final victory comes. If you are now making plans for the future, write for complete details and specifications.

*These are reasons why Lesters handle the tough jobs—(1) Vertical heating cylinder with hollow injection plunger produces high heating efficiency. (2) Operating range extended by extra interchangeable heating cylinders available for each model. (3) Positive die locking reduces flash on moldings to absolute minimum. (4) Perfect parallelism of die plates assured by central die adjustment. (5) Heavy alloy steel beam frame gives rigid support to die locking mechanism. (6) Complete range of sizes—4, 6, 8, 12, 16 and the new 22-oz. size for larger moldings.



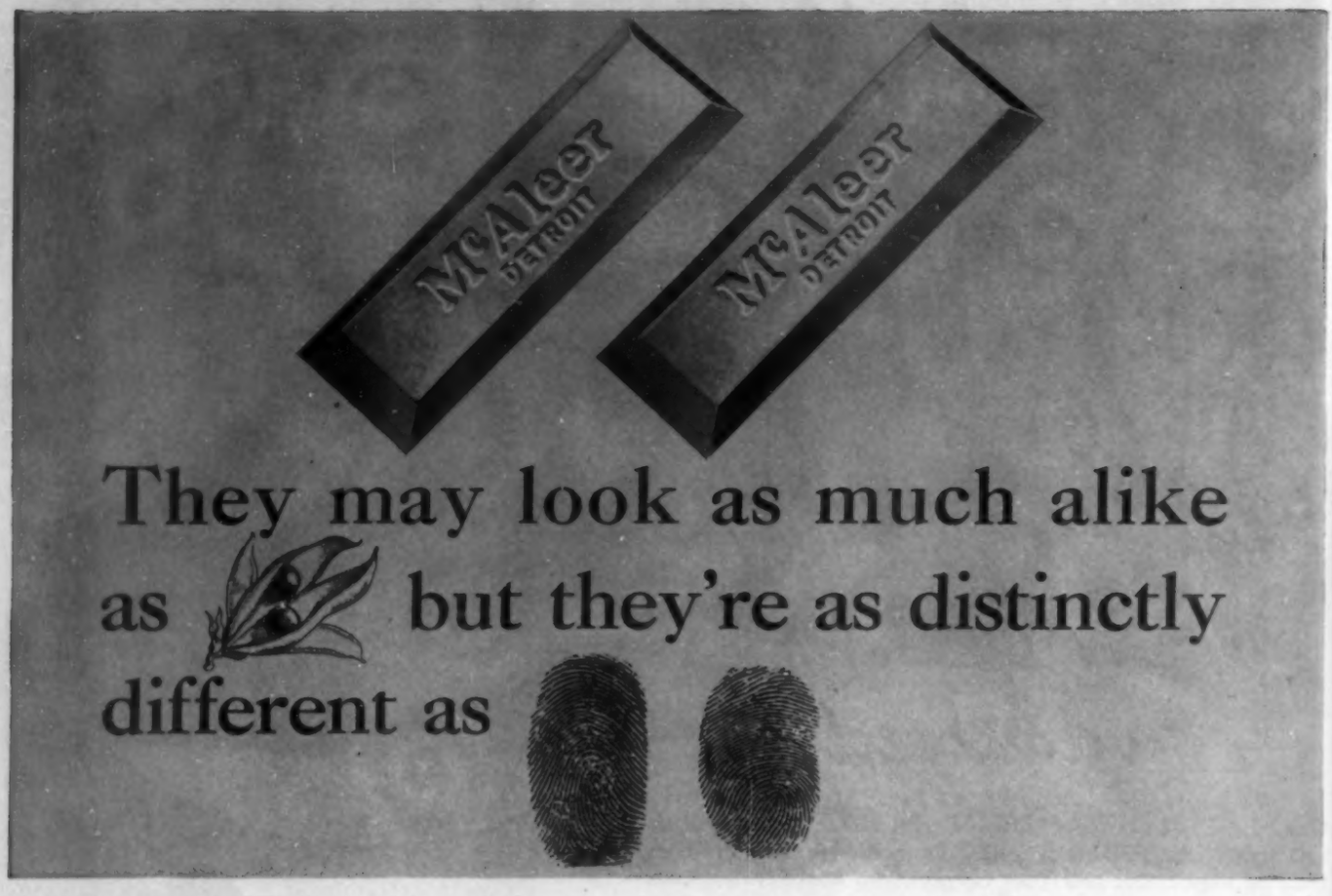
The 12-ounce Lester—one of six standard models

National Distributors:
LESTER-PHOENIX INC.
2711 CHURCH AVENUE
CLEVELAND, OHIO

LESTER
INJECTION MOLDING MACHINES

Representatives in
NEW YORK CITY • DETROIT
LEOMINSTER • LOS ANGELES
CHICAGO • SAN FRANCISCO
CINCINNATI

Foreign Agents
BOWDING & DOLL, LTD.,
LONDON, ENGLAND
SCOTT & HOLLADAY PTY. LTD.
SYDNEY, AUSTRALIA



WHEN we want to express similarity of things, we sometimes say "alike as two peas in a pod" . . . an apt comparison if we disregard what peas are for. When we eat them, they don't all *taste* alike . . . That's the way it is with BUFFING and POLISHING compositions.

There was a time when any "all-purpose" composition was acceptable in most instances for the general run of finishing work. War production finishing demands changed all that. Today the former user of "all-purpose" materials has come to realize that you can't specify the things that make a product really superior. Skill, knowledge, facilities and an honest desire to do a good job can't be standardized . . . McAleer finishing materials, whether used for polishing or buffing aluminum, brass, steel, copper, nickel, chrome and other metals, or for removing small flash or fins, file marks, blow holes, tool or die marks from plastics, are as distinctively different in their job-fitted characteristics as two thumb prints.

They are made to do an exacting job, do it well and keep on doing it as long as need for the specific type of material exists. Standards protect the manufacturer on those materials which must be buffed or polished; but when your compositions bear the McAleer trade mark, you get more than standards—you are protected all the way.

The nature of our business requires McAleer Finishing Engineers in the field to be virtually *"Jacks of all trades"*. And, contrary to the old adage, they are *masters* of many. Individually these men are specialists. As a body their specialty is *versatility*. This extra *"know-how"* possessed by McAleer Field Engineers backed by the second-to-none laboratory and manufacturing facilities are dedicated to but one purpose . . . helping you solve your individual finishing problems, whether those problems involve the finishing of metals or plastics . . . or both. Whichever it is, let us demonstrate McAleer service on your meanest finishing problem.

PHENOL-FORMALDEHYDES • UREA-FORMALDEHYDES • ACRYLATES and METHACRYLATES • STYRENES • HARD RUBBERS
CASEINS • ETHYL-CELLULOSES • CELLULOSE ACETATES • CELLULOSE ACETATE BUTYRATES • CELLULOSE NITRATES

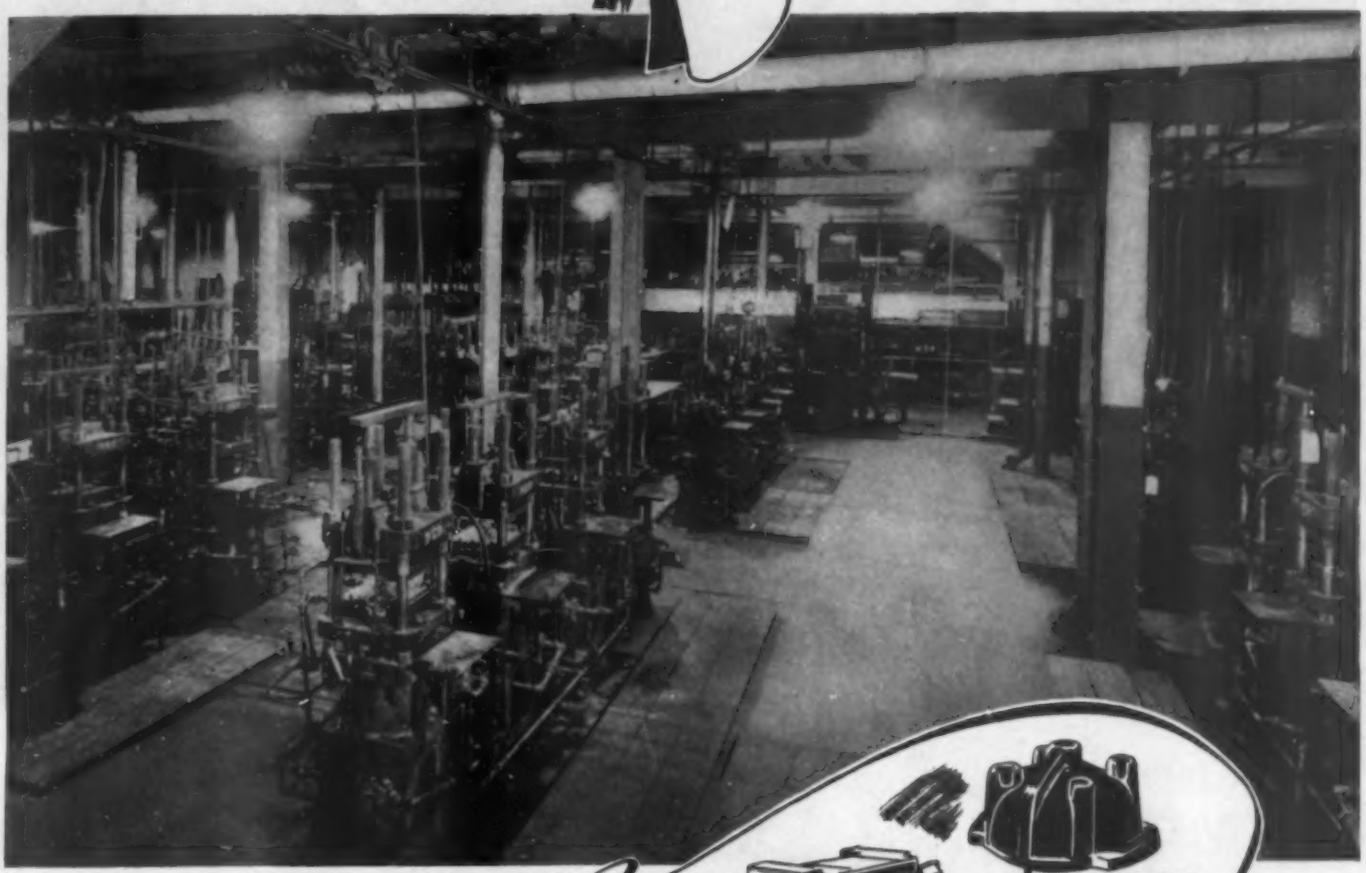
McAleer MANUFACTURING CO.

Manufacturers of Quality Controlled Finishing Materials

ROCHESTER, MICHIGAN

Your Blueprint ...in Plastic

A get-together with Consolidated on projected plastic products or parts is invited at the time your plastic thoughts first begin to shape their way into pencilled notes. It is then that practical plastic counsel can do the most good. Early-stage two-way discussions establish a mutually better understanding and pave the way to best final results. For that reason, our experienced sales-engineers welcome the opportunity of being a party to your plans. Inquiries accorded prompt response.



From materials to finished products, through the processes of compression, Transfer or Injection Molding! In Consolidated's Compression Department, alone, the press total is close to the one hundred mark and of sufficient capacities to handle broad-ranged plastic applications!

Consolidated

Molded Products *Corporation*

309 CHERRY STREET • SCRANTON 2, PA.

NEW YORK
1790 Broadway

BRIDGEPORT
Rocky Ridge Drive

CHICAGO
549 West Randolph St.

DETROIT
2970 West Grand Blvd.

CLEVELAND
3682 Ingleside Road
(Shaker Heights)

ENTIRE CONTENTS COPYRIGHTED 1943. CONSOLIDATED MOLDED PRODUCTS CORPORATION

VARCUM RESINS DO SINCE THEY "JOINED UP" WITH THE ARMY AIR CORPS

The nation's finest materials of every description go into the various planes used by our Armed Forces. We're proud to be included in this Honor Roll of select manufacturers who contribute to the construction of these hard hitting scourges of the Axis.

Varcum resins are used in the insulating varnishes that are applied to all the electrical wiring of the motors, the radios, the generators and other wound apparatus found on these planes. The realization that nearly two miles of electrical wiring are used on the Airacobra and approximately five miles of wire for the Flying Fortress establishes the importance of these insulating varnishes in the building of modern fighting aircraft.

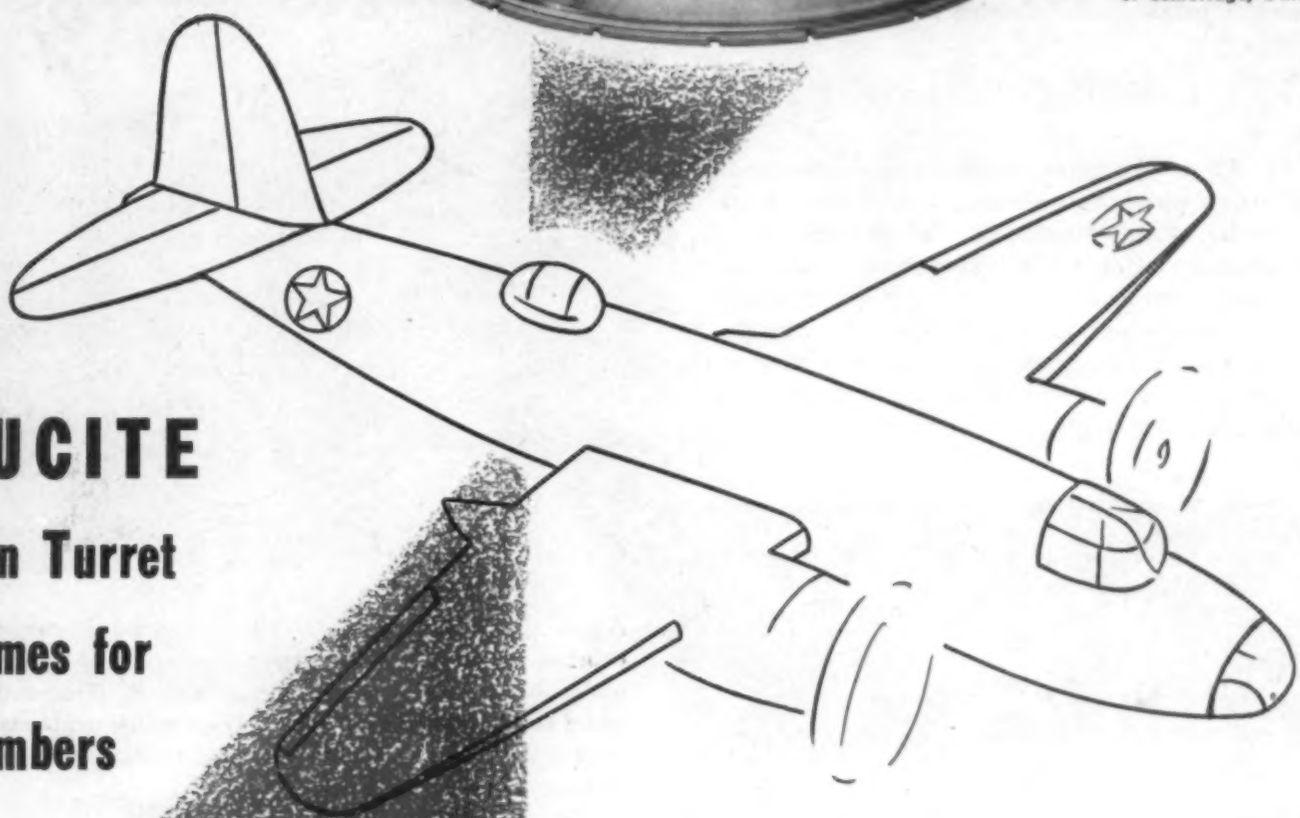
This represents another conspicuous achievement of the technical staff of the Varcum organization. These resins were designed to solve specific problems . . . and do this with outstanding success.

Got a resin problem? Let us go to work on it!

VARCUM
CHEMICAL CORPORATION
NIAGARA FALLS, NEW YORK

CUSTOM-MADE RESINS FOR THE WORLD'S FINEST PRODUCTS

LUCITE Gun Turret Dome for Bombers as manufactured by Reynolds Molded Plastics Division, Reynolds Spring Company of Cambridge, Ohio



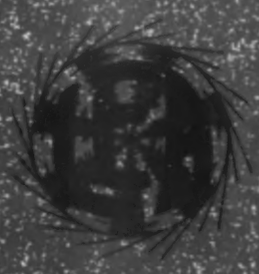
LUCITE Gun Turret Domes for Bombers

are being finished by the LEA Method *with* LEA Materials

Reynolds Molded Plastics Division, Reynolds Spring Company of Cambridge, Ohio, is doing its share in important war work, turning out gun turret domes for bombers made of LUCITE, a well-known and widely used Du Pont plastic.

Such Products need careful finishing with just the right material. Costs must be watched. That the LEA Method, making use of LEA Materials, was adopted by the Reynolds Spring people is, we like to feel, a tribute to our technical help along finishing lines. Here is another of the many instances where, with our broad experience with cutting down, polishing and buffing problems, we have helped war industries working with plastics.

If your product requires any degree of finishing, why not let us see if the LEA Method with LEA Materials won't do a better job more economically?



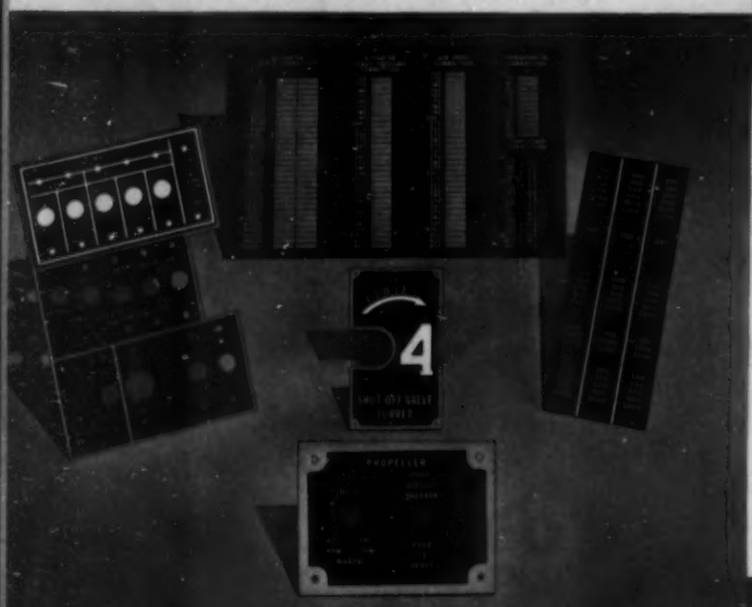
THE LEA MANUFACTURING CO.
WATERBURY, CONNECTICUT

Burring, Buffing and Polishing . . . Specialists in the Development of Production Methods and Compositions

LAMICOID FOR PRECISION

wherever eyes scan . . . or fingers operate

PLASTICS may be scarce but there are still thousands of places where the advantages of Lamicoid are *indispensable* to the operation of vital war equipment. For a constantly handled drift calculator or a fluorescent aircraft instrument panel . . . for a rear-illuminated gun fire control dial or an operating chart on which computations are made . . . Lamicoid offers a variety of materials to meet any manufacturing or operating characteristic.



Above are examples of Graphic Lamicoid in which printing calibrations and designs are permanently bonded under the surface of the plastic resin sheet. The small white panel has a special finish 2-D on which temporary records are made in pencil or ink and repeatedly erased without wear on the material.

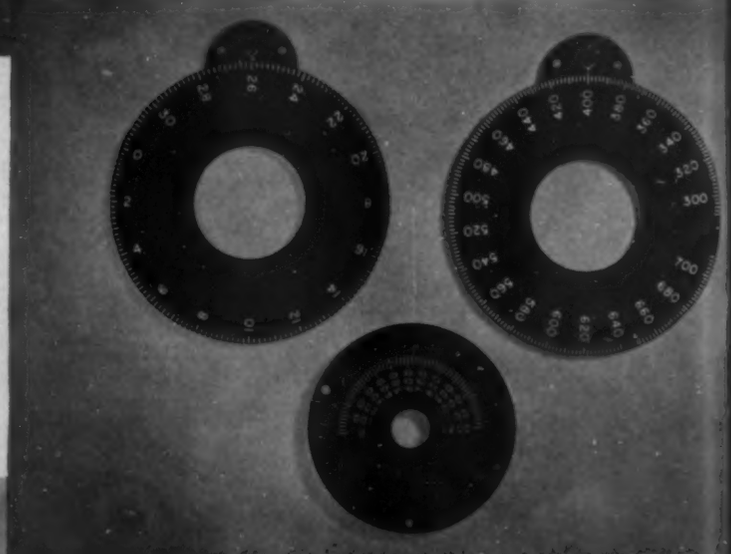
☆ ☆ ☆

At left are examples of Fluorescent Lamicoid in which fluorescent pigments are permanently incorporated into the sheet for illumination with ultra violet or "black" light.

At right are examples of Engraving Lamicoid in which lettering figures and designs are engraved through the lustrous "sandwich type" sheet exposing the contrasting core. Available either with an opaque core or a translucent back for rear illumination.

☆ ☆ ☆

Investigate Lamicoid for your requirements by sending samples or blueprints. We will quote prices promptly on any essential application.



MICA INSULATOR COMPANY

200 VARICK STREET, NEW YORK 14, N. Y. · 600 VAN BUREN STREET, CHICAGO 3, ILL. · 501 MARION BLDG., CLEVELAND 13, OHIO

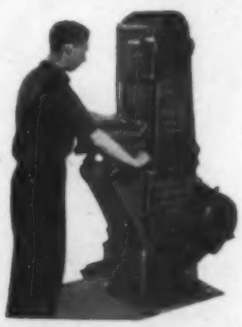
Representatives in principal industrial centers

Send for the Complete Story of Wet Belt Surfacing

The Proved Finishing Method That . . . .

- produces superior work, 5 to 25 times faster than previous methods.
- holds close limits, often .0005".
- works on entire area at once.
- eliminates dust or grit, injurious to other equipment and to health.
- eliminates heat, warping, distortion, discoloring, fracturing, chipping.
- needs fewer, and only simple, inexpensive jigs.
- cuts set-up time and lock-up time—often eliminates both entirely.
- reduces cost of equipment, operation and maintenance.
- permits inexperienced workers to get increased production and superior finish.
- replaces other machine tools on many operations, and supplements others to improve results.

Porter-Cable's latest book et "A New Precision Machining Method," gives you complete information on one of the most valuable machining helps for both hard and soft metals, stainless steel, plastics, compositions, ceramics, glass, that has come out in years. Because of the great demand for this booklet, it can be sent only to those who furnish us their title, company name and address. Fill in the coupon, clip to your letterhead, and mail today.



PORTER-CABLE MACHINE CO.
1606–11 N. Salina St., Syracuse, N. Y.

GET ALL THE FACTS . . .

PORTER-CABLE MACHINE CO.
1606–11 N. Salina St., Syracuse, N. Y.

I would like to receive your new treatise on WET-BELT SURFACING, the New Precision Machining Method. I understand the book will be sent me entirely without obligation.

Individual.....

Position.....

Company.....

Street.....

City.....State.....

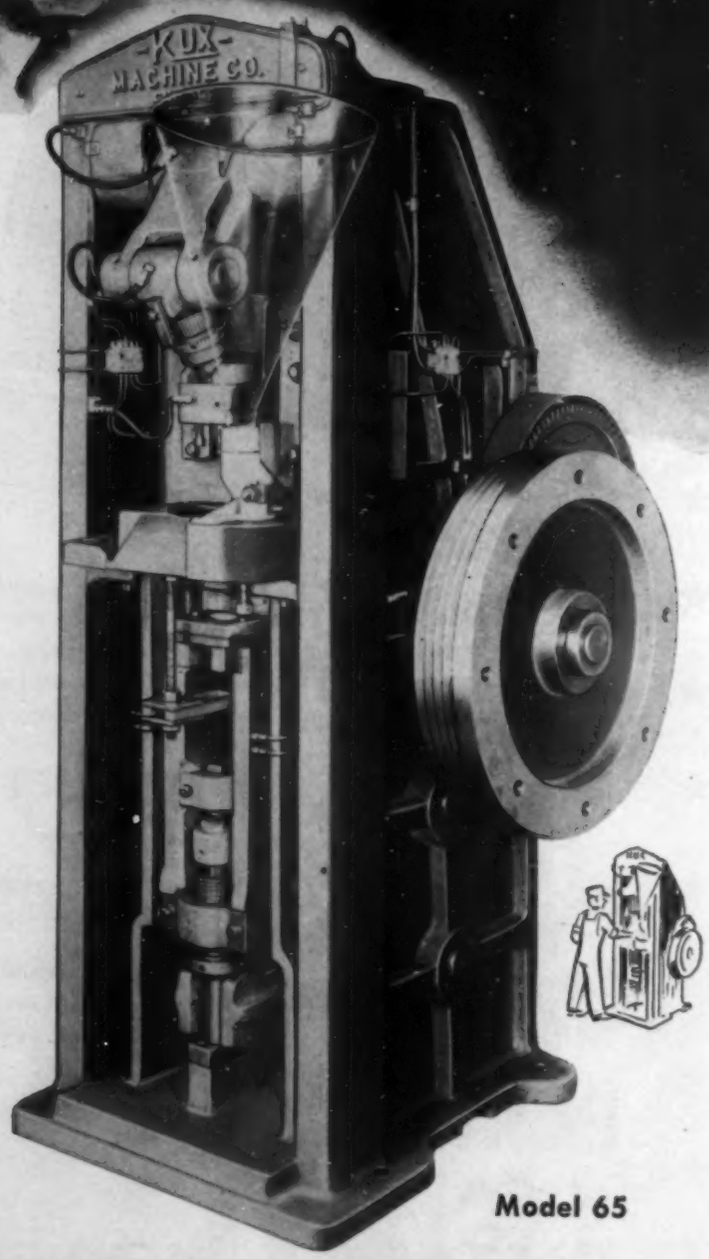
PLENTY
RUGGED

Kux Preform Presses

THE NEW MASSIVE MODEL 65 PRODUCES PREFORMS 3" DIAMETER, HAS A 3" DIE FILL AND APPLIES 75 TONS PRESSURE

This rugged preform press with its heavy duty, one-piece cast steel main frame will produce odd shapes as well as round preforms. The pressure applied by both top and bottom punches results in more solid, dense preforms, which have less tendency to crumble or break during handling. This new Model 65 press is built to safely withstand high pressures of up to 75 tons at top production efficiency.

Choice of a complete size range of machines in both single punch models and multiple punch rotaries is also available.



Model 65

KUX
MACHINE
COMPANY
3924-44 W. Harrison St., Chicago

● Write Dept. P for catalog or demonstration

Object lesson-

IN MOLDED PLASTICS

for designers, production men and executives

ONE object, but it illustrates two lessons—in any industry, conversion to plastics, where indicated, usually improves *both* product and production. Shure Brothers discovered them both when they (together with our engineers) pioneered the use of plastics in microphones.

From the production (and cost) angle, plastics released vital aluminum for other uses, and plastics were available! Because of increased accuracy, 100 men and machine hours were saved on every 1,000 units and assembly operations were simplified accordingly.

As for the product itself, in plastics the case weighs half as much while still meeting all strength requirements. It's safer because of plastics' electrical insulating qualities; easier to use in any climate because of the heat insulating properties, and the more attractive, streamlined design allows greatly simplified maintenance.

In many industries, these qualities deserve fullest consideration in post-war production and sales plans, and they're only a few of the many that plastics offer. Of equal importance is your choice of molder—one like ourselves, for instance, who offers complete facilities for engineering, mold-making, molding and finishing; the largest, best equipped plant in the Middle West; a proven record of accomplishment. It's not too early now!

CHICAGO MOLDED PRODUCTS CORPORATION

Precision Plastic Molding

1046 NORTH KOLMAR AVENUE, CHICAGO 51, ILLINOIS

COMPRESSION, INJECTION AND TRANSFER MOLDING OF ALL PLASTIC MATERIALS

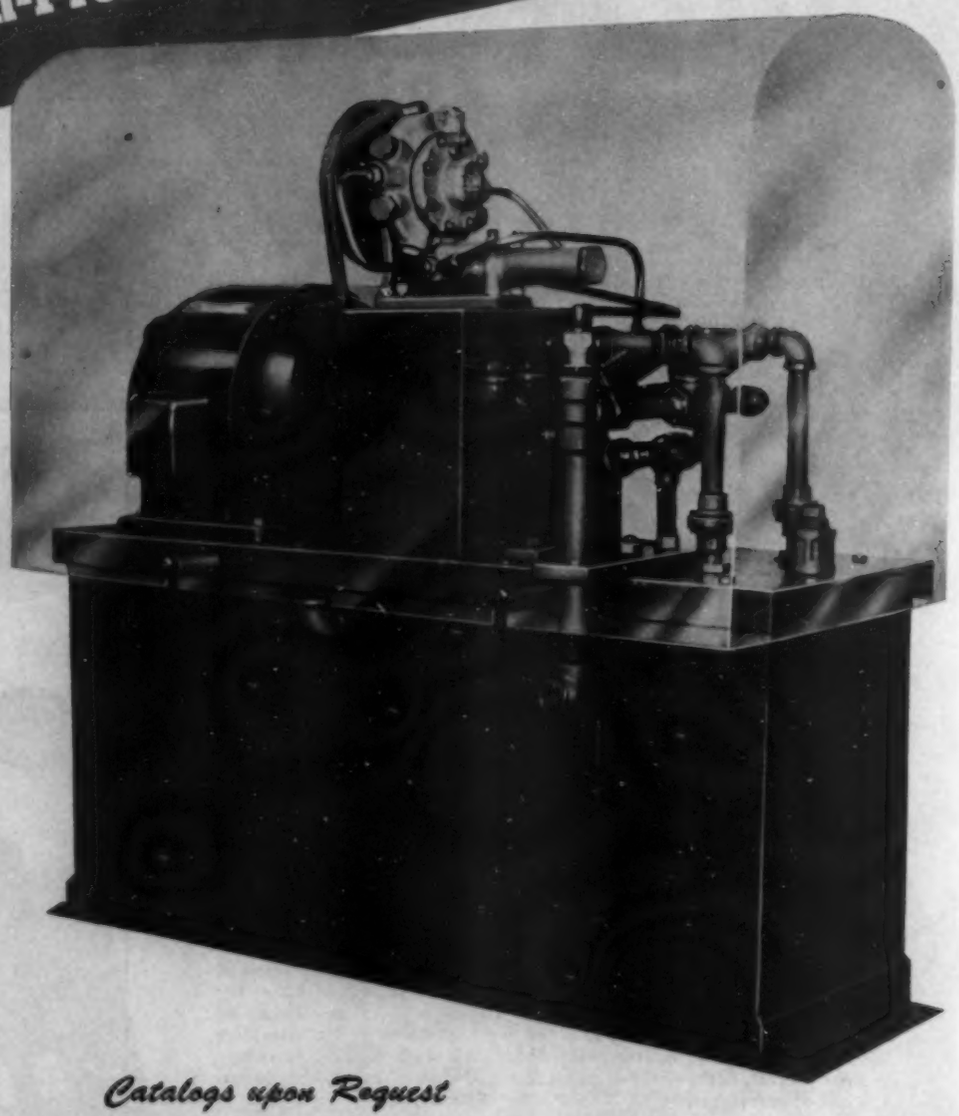
HYCON

Hydraulic Pumps and Valves for High-Pressure Systems

Speed-Economy

•

Small compact units for Machine Tool and Equipment Applications



Hycon Belt-Driven Pump and Control Valve on Shriver Pumping Units for Hydraulic Closing of Filter Presses

•

Complete Engineering Facilities without Obligation

•

STANDARD EQUIPMENT FOR IMMEDIATE DELIVERY

Catalogs upon Request

THE NEW YORK AIR BRAKE COMPANY

Hydraulic Division

420 Lexington Avenue, New York 17, N. Y.

PLASTICS—
FOR WAR AND POST-WAR

EXTRUSION *and* INJECTION MOLDINGS

Here, in a *modern* plant with every facility for design and production of extruded or injected moldings, prompt and competent service under expert technicians and engineers assures you quality in raw materials, lustrous finished products and "know-how."

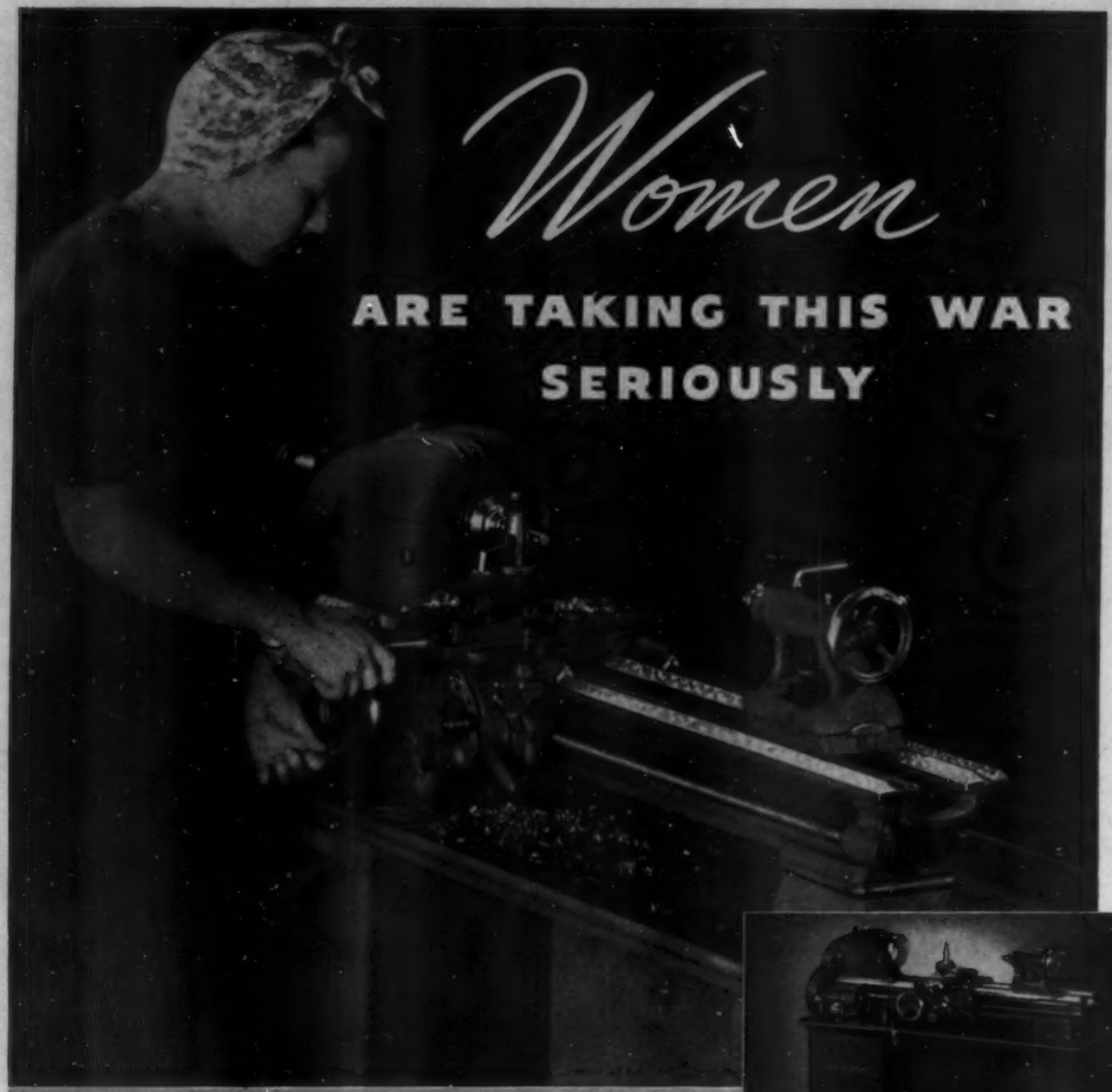
Celluplastic Corporation is a pioneer in Plastics; a thoroughly dependable organization serving the Industry for 25 years! *Ask for details on what YOU need!*

FIRST IN CELLUPLASTICS
HYCOLOID-CLEARSITE

CELLUPLASTIC CORPORATION

EXTRUSION AND INJECTION MOLDERS

40 AVENUE L NEWARK, N. J.



SOUTH BEND LATHES

9" swing, South Bend Engine Lathe

With grim determination thousands of American women are doing their best to fill men's shoes. Eagerly they bend their shoulders to wartime tasks—for no sacrifice is too great if it hastens the return of their men from the fighting fronts.

In hundreds of vital war plants, women are operating South Bend Lathes with surprising results. On all kinds of jobs, they have kept up production and maintained established standards of precision. In some factories whole batteries of South Bend Lathes are humming under the guidance of feminine hands.

Since World War I, women operators have preferred South Bend Lathes. Their nimble fingers find the convenient controls well suited to their sensitive touch. They like the fully enclosed design. And, most of all, they appreciate the ease of operation that prevents fatigue and makes the workday seem shorter.

South Bend Engine Lathes and Toolroom Lathes are made in five sizes: 9" to 16" swings, with 3' to 12' bed lengths. The Turret Lathes are made with 9" and 10" swings. Write for Catalog 100C which describes all sizes and types of South Bend Lathes.

BUY WAR BONDS

SOUTH BEND LATHE WORKS

Lathe Builders for 37 Years
SOUTH BEND 22, INDIANA

CALL FOR A SHOW OF HANDS

Skilled AND *Capable*

You have good reason to entrust to us any questions of plastics relating to your manufacture or your product. We have had the opportunity, as custom injection moulders, to explore thoroughly the applications of plastics from every engineering angle, and to devote ourselves wholly to each customer's problem free of any proprietary interest.

When you ask for a show of hands — skilled and capable in plastics engineering, rely on the Trio — engineer-trained, service-minded, and exceptionally equipped.

These facts plus our plastic moulding experience have satisfied many manufacturers that we know how —even as we now discuss with them to-morrow's plastics production.

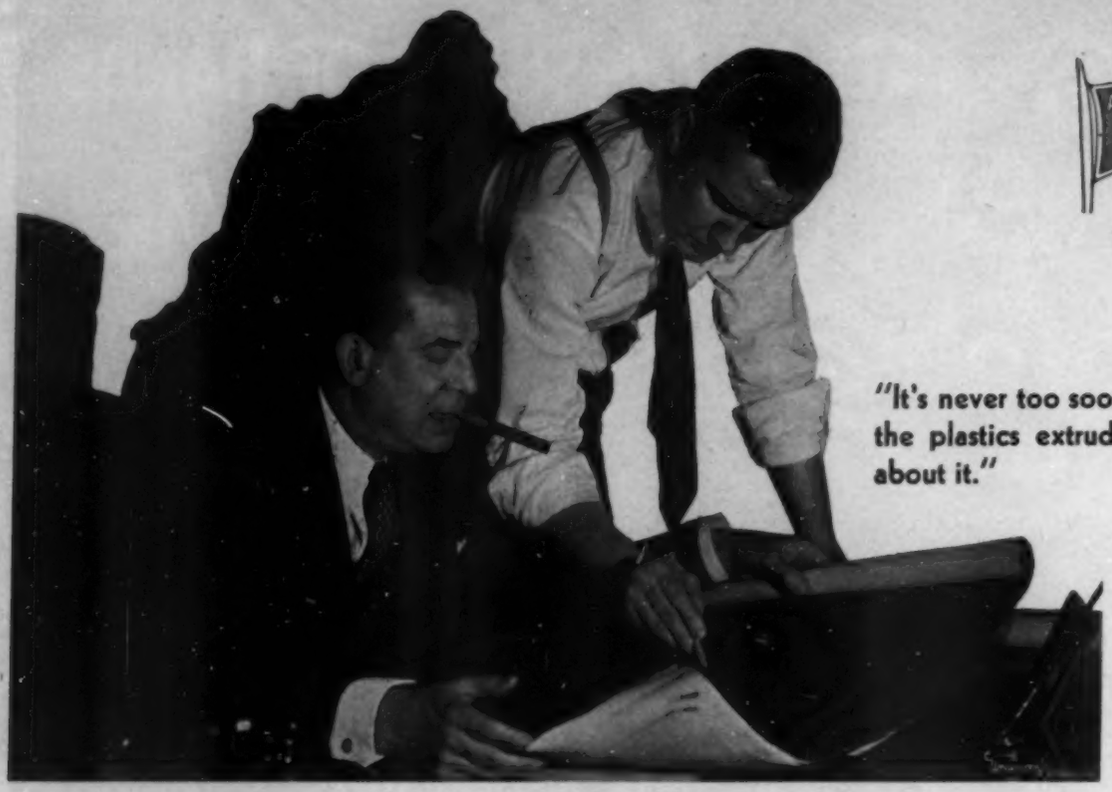
For Custom Injection Moulding . . . try the Trio

ARMY E NAVY

Custom Injection TRIO *Moulders*

WORCESTER MOULDED PLASTICS COMPANY

8 GRAFTON ST., WORCESTER, MASS. 17 E. 42nd ST., NEW YORK, N.Y.



ARMY E NAVY

Let's Work and Fight for the Free America We Love

"It's never too soon to find out about the plastics extruder. Ask ROYLE about it."

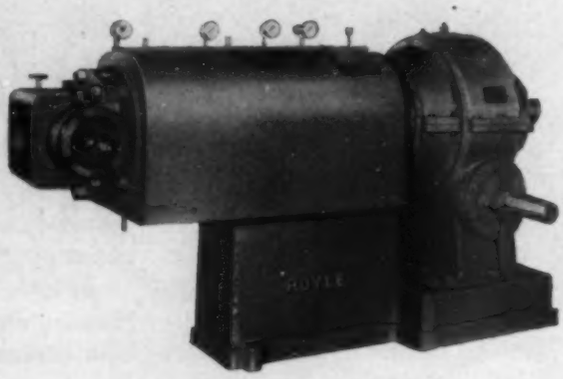
Build Your Plans for the Future Around

ROYLE PLASTICS EXTRUDERS

ROYLE extruders for plastic substances are highly flexible in their adaptability to the constantly changing requirements of the plastics industry.

•

So many of them are now in successful use, for so many different kinds of plastics, that you can base your post-war plastics production plans on the availability of



--ROYLE PLASTICS EXTRUDERS--

to do any kind of work you may require of them. We made our first plastic extruder in 1888.

JOHN ROYLE & SONS

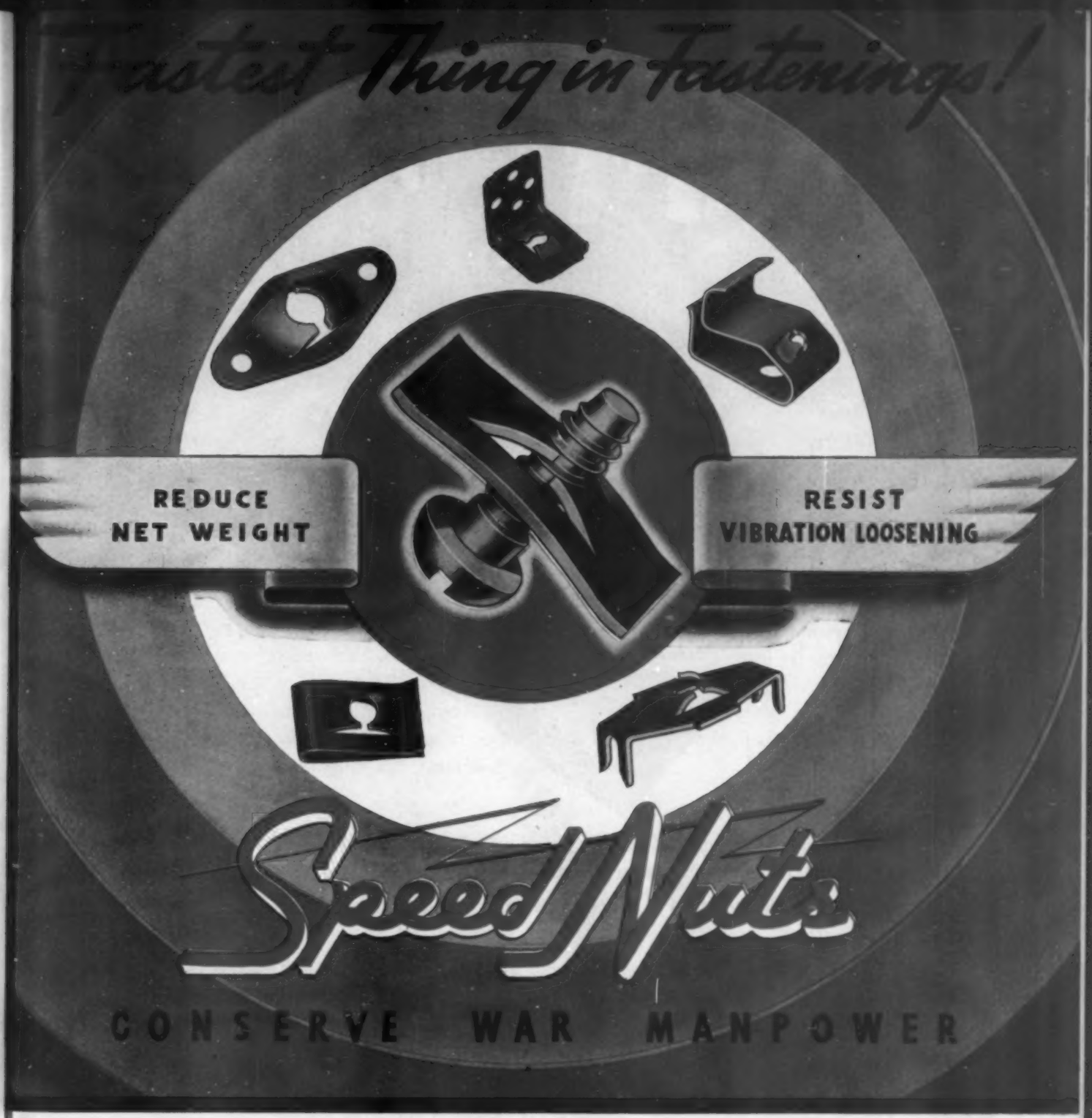
PATERSON 3, NEW JERSEY

BUILDERS OF A LINE OF GREAT EXTRUDERS FOR RUBBER AND PLASTICS

ROYLE PATERSON N.J.

AKRON, OHIO
Represented by **J. C. CLINEFELTER**
UNIVERSITY 3726

LONDON, ENG.
Represented by **JAMES DAY (MACHINERY) LTD.**



SPEED NUTS have become industry's universal fasteners because:

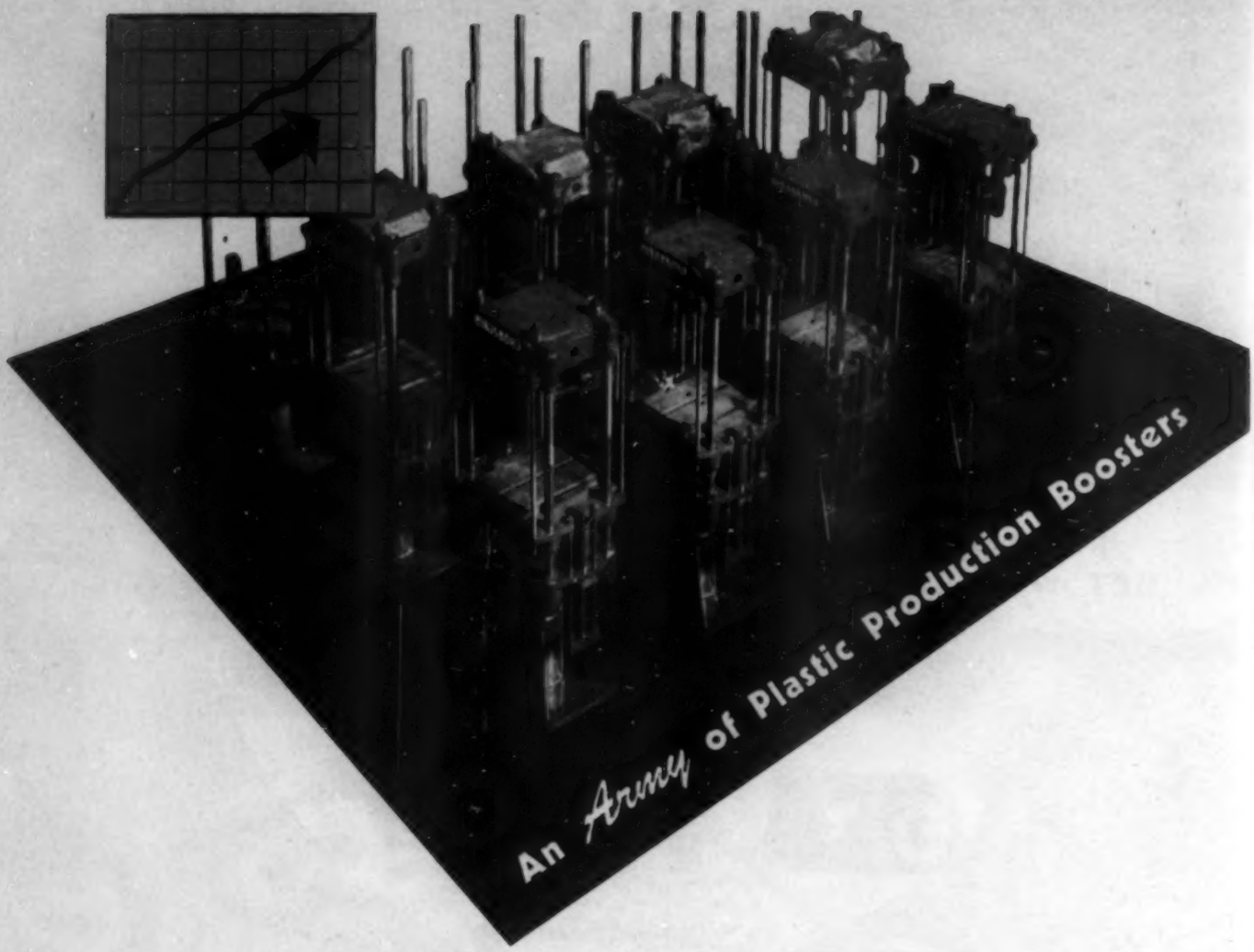
1. They do not shake loose with vibration.
2. They reduce weight and conserve critical metal.
3. They are applied faster and conserve war manpower.
4. They lower net assembly costs.

Month after month, tons of critical material and countless man hours assembly time are being saved by conversion to spring steel SPEED NUTS. The faster this conversion is expanded the quicker SPEED NUTS will pay you even bigger dividends. In writing for samples, kindly give engineering details to expedite quick selection of SPEED NUT adapted to your needs.

TINNERMAN PRODUCTS, INC. • 2048 Fulton Road, Cleveland, Ohio

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario

In England: Simmonds Aerocessories, Ltd., London



● These plastic presses, part of an army of 72 presses of various sizes, are serving one of America's foremost plastic manufacturers, handling general plastic molding work.

In plants from coast to coast, Birdsboro Plastic Presses like these are passing the toughest performance tests with ease. Minimum maintenance—maximum performance . . . that's the keynote to their success. And each is practical testimony of Birdsboro engineering skill at work.

Birdsboro will be glad to help you solve your press problems. Call on us.

BIRDSBORO STEEL FOUNDRY & MACHINE COMPANY • BIRDSBORO, PENNSYLVANIA

BIRDSBORO

HYDRAULIC PRESSES

GUINEA PIGS

Riegel-X, a group of base papers for plastic laminates, was "guinea-pigged" long ago in the Riegel laboratories and by a few customers who allowed us to use their plants as a practical proving ground. Thus, experimentation is a thing of the past with Riegel-X Papers. They come to you tested and approved by many leading plastic laboratories—for when we publicly offer a new product we do not expect you to be our "guinea-pig."

X

Outstanding operators are now using Riegel-X Papers to make a large variety of products that have been in service on land, at sea and in the air for many months—with complete satisfaction.

X

Riegel-X is a vital, revolutionary material that is helping to win the war and that has remarkable post-war possibilities. The information gathered since the inception of high-strength paper base plastic laminates, as well as the papers themselves, are available now. Write for technical data and samples to RIEGEL PAPER CORPORATION, 342 Madison Avenue, New York 17, N. Y.

RIEGEL-X

X **A group of plain and impregnated base papers for both fluid and direct pressure plastic laminates.** X

92

Problem in Pigments?

CALL ON WISHNICK-TUMPEER

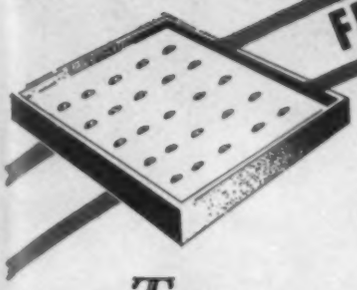
Carbon Black • Clay • Mica • Titanium Dioxide • Yellow Iron Oxide • Red Iron Oxide • Lithopone
Calcium Stearate • Zinc Stearate • Cadmium Red • Cadmium Yellow • Chromium Green Oxide
Witcarb (Precipitated Calcium Carbonate) • Stearite (Hydrogenated Stearic Acid) • Asphalt Specialties

WISHNICK-TUMPEER, INC.

MANUFACTURERS AND EXPORTERS

New York 17, 295 Madison Ave. • Boston 9, 141 Milk St. • Chicago 11, Tribune Tower • Cleveland 14, 616 St. Clair Ave., N. E. • Witco Affiliates: Pioneer Asphalt Co. • Panhandle Carbon Co. • Foreign Office, London, Eng.

FROM PILLS TO AIRPLANE PARTS



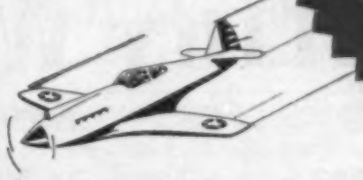
THIS huge Kux automatic powdered metal and ceramic press weighs 13,500 pounds, stands 11 feet high, and is doing a "bang out" job of producing everything from medical and vitamin pills to airplane parts for our Armed Forces.

Timken Graphitic Steel is helping Kux presses do an exceptional wartime job. Their cam inserts, cam rollers, roller pins, dies, punches, and core rods are made of Timken Graphitic Steel. The Kux Machine Company reports that Graphitic dies provide exceptional life, have excellent hardening properties and easy machinability.

"In nearly two years of service, none of the Graphitic press parts have required replacement," say Kux engineers.

Would you like to know more about this free-machining, long-wearing tool and die steel? A request on your company letterhead will bring you the latest edition of the Graphitic Steel Booklet. The Timken Roller Bearing Company, Canton, Ohio. Steel and Tube Division.

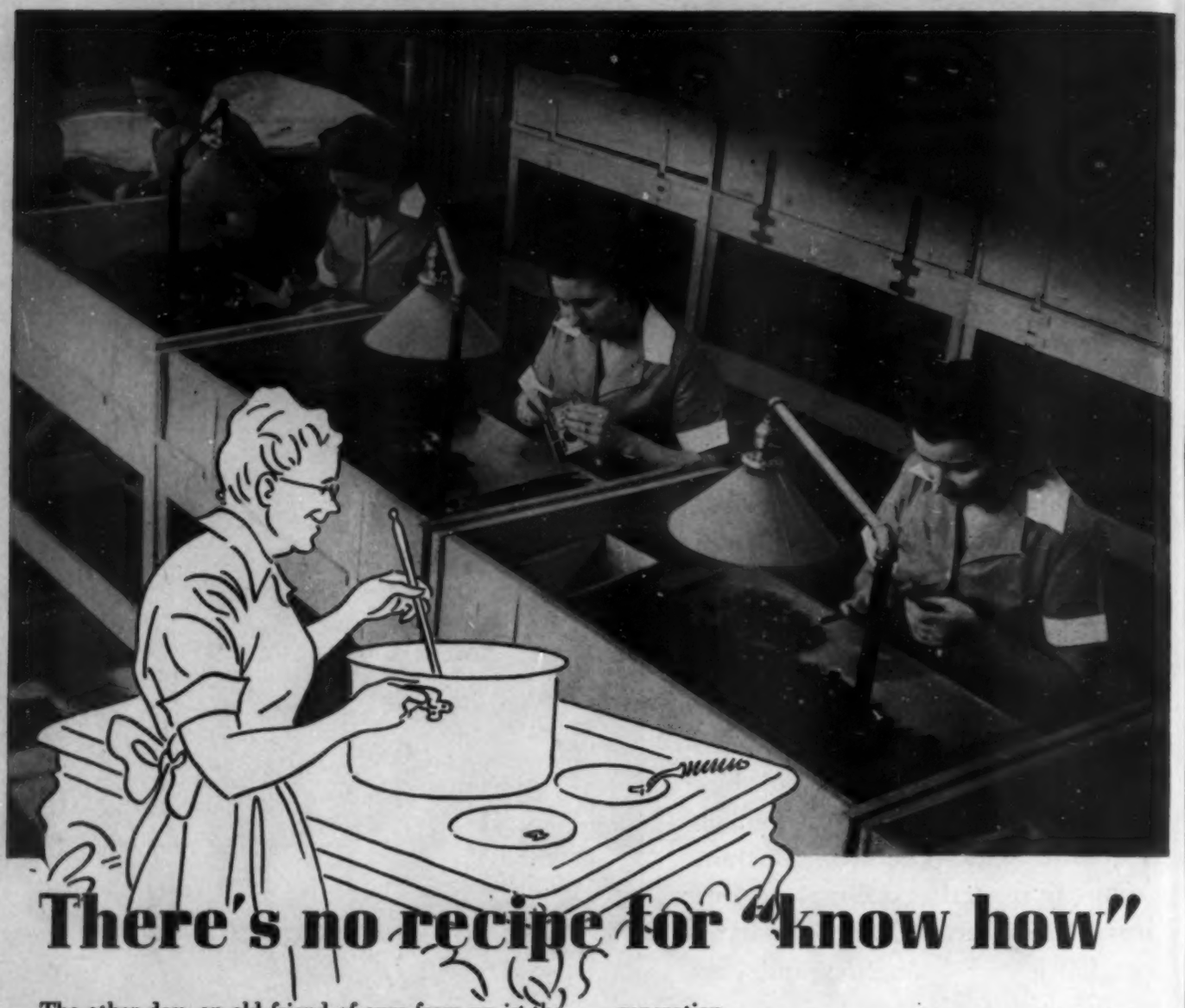
The one test for every decision-- Will it help to win the war?



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

GRAPHITIC STEELS



There's no recipe for "know how"

The other day, an old friend of ours from up in the hills back of our town, brought us in a crock of apple-butter. Just thinking about it, as it sat on our desk, made our mouth water.

There's a real art to the making of old-fashioned apple-butter that can't be set down in any recipe. Making it takes all day and part of the evening while the spicy fragrance of simmering sweet cider rises from the gleaming copper kettle to mingle with fragrant wood smoke filling the air with as appetizing a scent as ever tempted the nostrils of a hungry man. It's an art that has been handed down from mother to daughter for generations.

As he left, the busy sounds of the plant drifted in to us at our desk, we got to thinking about that "know how" that is passed down from generation to generation.

Here in our plant, the machines are new and shiny —a far cry from the molding equipment with which we started back in 1876 . . . but somehow the whole organization here seems to have a familiarity with plastic molding that can be accounted for only by all those years of "doing." We see the evidences of it in the die-making, the molding and all along the line. It's a familiarity that seems to iron out the wrinkles in the toughest jobs . . . that lets us tackle the impossible and come up with an answer nine times out of ten.

Besides "know how" in compression, transfer and injection molding—we also are extruders of all the new materials in various shapes and tubing sizes. We also produce cellulose nitrate in sheets and rod form.

MOLDED PLASTICS DIVISION

AUBURN BUTTON WORKS, INC.

Molders of All Types of Plastic Materials by Compression, Transfer Injection and Extrusion Methods

ESTABLISHED 1876 • AUBURN, N. Y.

under a soldier's helmet

More than a "tin hat", a soldier's helmet is his shock absorber, his battle turret—in a pinch even his wash tub! Into every helmet is fitted a one-piece liner molded of laminated plastic. Richard Brothers' Division of Allied Products Corporation was among the first to make the two-piece steam-heated molds on which these liners are formed. To this and other war assignments in the field of plastic molds, Richard Brothers' Division brings its years of experience in producing quality metal working dies.

ALLIED PRODUCTS CORPORATION

Richard Brothers' Division • 1560 East Milwaukee, Detroit, Mich.

"IT'S AN ALLIED PRODUCT!" . . . Richard Brothers' Division of Allied Products Corporation also produces the famous R-B patented standardized Interchangeable Punch and Die used in processing laminated plastics.

DoALL BAND FILER

9 Times Faster THAN HAND FILING

For internal *file broaching* the band is opened, inserted through the work and snapped together in only a few seconds.

DoALL Band Filer with motor and all moving parts fully enclosed occupies less than 2½ x 3 feet of space.

An hour's filing job done in six or seven minutes because, with DoALL, filing is merely a matter of *feeding the work!* Metal is removed in clean cut, curved chips constantly while the work is fed against the endless band of precision fit, interlocked, file segments.

New accuracy too! Positive controls of work and file speed permit filing to "die-fit" tolerances—smooth machined finishes—by relatively inexperienced operators.

Investigate the vastly greater efficiency of DoALL Band Filing—in production, tooling or maintenance work—on all metals from tool steel to soft brass and wood, fibre and plastics, too! Telephone your nearest DoALL Sales Office—now!

FREE: Bring or send your filing problem for a complete time-and-method study—*the* DoALL *way.*

DoALL SALES OFFICES IN 34 PRINCIPAL CITIES

BAND FILER IS MANUFACTURED BY CONTINENTAL MACHINES, INC.

ADDRESS INQUIRIES TO 1301 WASHINGTON AVE., SOUTH, MINNEAPOLIS, MINN.

NUMBER 5 IN A SERIES OF EDUCATIONAL ADVERTISEMENTS ON TRANSFER MOLDING

REEDOM FROM INTERNAL FLAWS

One molding bugaboo — the trapping of gases deep within the material while it sets — is almost completely eliminated by TRANSFER MOLDING.

By assuring rapid and complete material flow into every interstice of even the most complex mold, TRANSFER MOLDING assures higher and more uniform density of the molded article, and eliminates gas pockets without wasting time and manpower in "breathing" the molds. The finished article is, of course, relatively stronger because of the greater density and freedom from internal flaws.

This is another of the advantages of TRANSFER MOLDING — automatic handling thermosetting materials — which is causing expanding adoption of the method by molders throughout the country.

TRANSFER MOLDING is the best way to

- Handle inserts—metal, glass, ceramic
- Mold high-impact materials
- Mold unsupported cores
- Achieve maximum dimensional accuracy
- Reduce trapped gases
- Lower mold costs
- Lengthen mold life
- Increase molding speed
- Reduce finishing costs
- Improve uniformity of cure regardless of cross-section
- Save material by eliminating flash
- Get practical solution to difficult molding problems

—on thermosetting plastics.

SHAW INSULATOR CO.

IRVINGTON SHAW NEW JERSEY

Watson-Stillman Laboratory Presses are available in capacities from 10 to 200 tons, with platen dimensions from 6 in. square to 15 x 18 inches.

TEST IT FIRST *on a* WATSON-STILLMAN LABORATORY PRESS

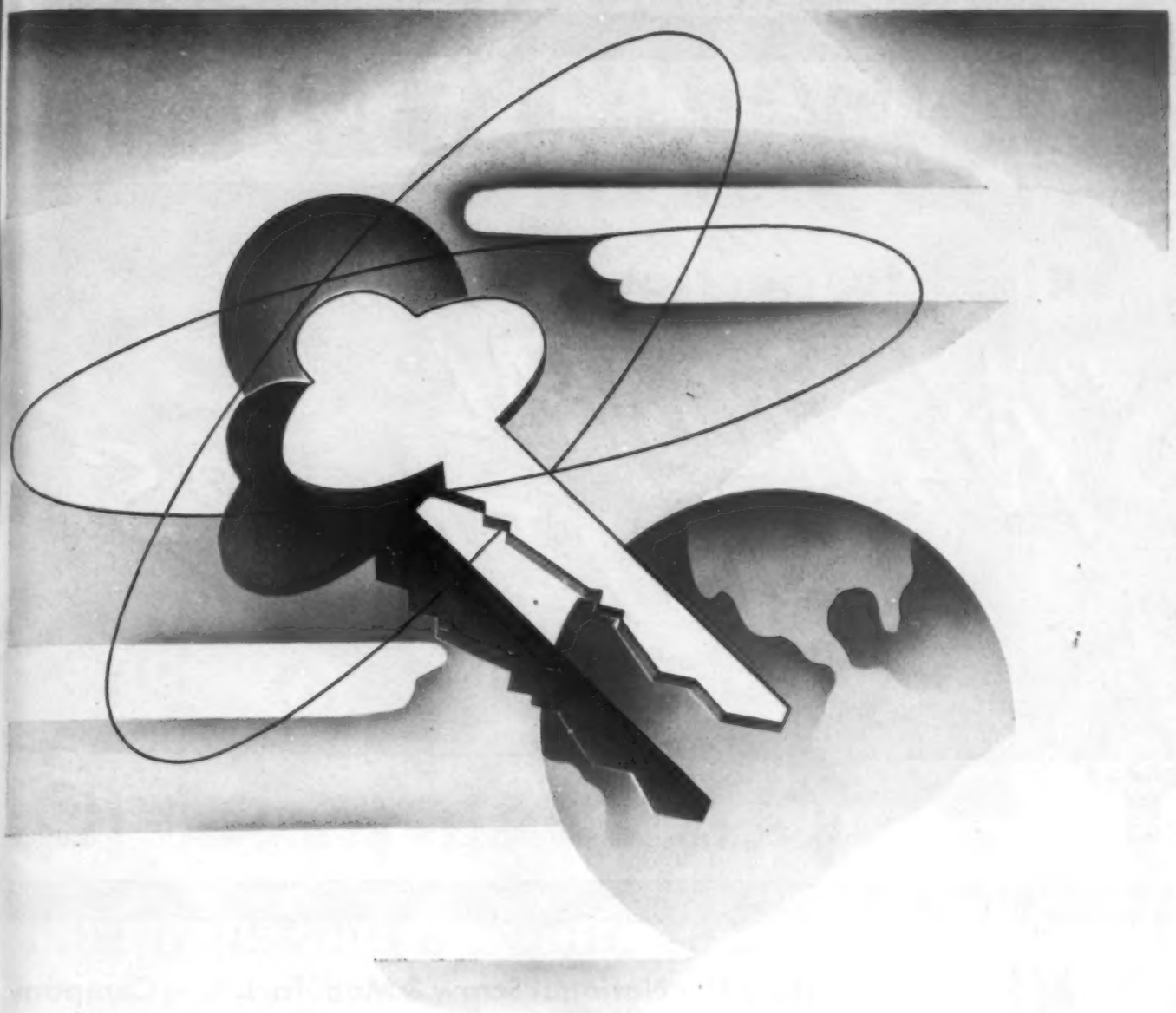
These sturdy four-rod Hydraulic Laboratory Presses are especially useful for testing, and for experimental work to obtain data needed in process or production problems. They furnish pressures from 10 to 200 tons on comparatively small areas, on die work or on straightening and compression tests. The versatility of these presses is indicated by their wide adaptability for die sinking or hobbing; extraction of liquids from vegetable seeds, chemical cakes, fats; briquetting; hot molding; testing concrete; and compression and bending tests on various materials

Fitted with electric or steam heated platens, these machines can be used as hand-operated hot molding presses. Accessories furnished as extras include steam plates, electric heating plates, swivel bearing plates, cage equipment, plate and cloth equipment, filter pads and additional gauges. The Watson-Stillman Co., Roselle, N. J.

WATSON-STILLMAN

Engineers and Manufacturers of Hydraulic Machinery and Equipment, Forged Steel Fittings and Valves

For Victory ★★★ Lets all be Scrappers



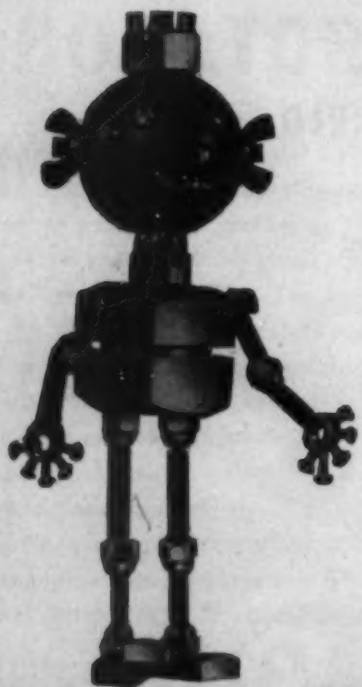
KEYED TO THE POSTWAR WORLD

Our facilities for producing precision plastic moldings in quantity are presently concentrated on war production, but our thinking and planning are keyed to the postwar world. Whether your plans require a single plastic part or an entire molded product with new merchandising features, our resources are at your command.

THE PYRO PLASTICS COMPANY

WESTFIELD • NEW JERSEY

Rigid Inspection of "NATIONAL" FASTENERS insures quality



How The National Screw & Manufacturing Company has maintained its original plan of making only one line of fasteners . . . a quality line

The National Screw and Manufacturing Company line of fastening devices—screws, nuts, bolts and kindred products—has established an enviable reputation in industry, has long been known as top-drawer fasteners.

Though there have been many changes in industry served by "National Screw" in the past 54 years, "National" has maintained its original policy of making only one line of fasteners—a front-rank quality line. *Rigid Inspection of every product has made this possible.*

Thus, if you are looking for fastening devices that "hold tight"—drop us a line. We may not be able to supply all your needs at present—but we can and will give you the full benefit of our years of practical experience in making quality fasteners.

National
HEADED AND THREADED
PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND, O.

MODERN PLASTICS

VOLUME 21 NOVEMBER 1943 NUMBER 3

PHOTO, COURTESY NORTH AMERICAN AVIATION, INC.

The bomb rack is attached to the underside of each wing as shown in this sketch

The Mustang's bomb rack

by KEN WEST

PLASTICS have taken on some tough assignments in this war. None, perhaps, have been tougher than the job given the bomb rack on North American's Mustang which went into combat service a short time ago and rendered an account of perfect performance in North Africa, Pantelleria, Sicily and Italy. What these spunky little fighters did to the Axis welcoming committee is well known. After taking on all comers in the upper ether on their way to a prearranged goal, they slithered down to lay two 500-pounders on their target before streaking back to headquarters for another load. The part of the story that hasn't been told before is that the Mustang's bomb toters, fastened to the aluminum structure of the ship on the underside of each wing, are molded of canvas-filled phenolic plastics. Their position may be seen in the artist's sketch. The Mustang bomb rack, it might well be to explain, is an external detachable device that can be put on or taken off the ship at will. It should not be confused with the type of rack that is built into our larger bombers—within the belly of the ship—and protected from air stream by bomb bay doors.

The plastic rack, which weighs about 7 lb., is a slender little 4-legged device that resembles an alligator with its top half removed (Fig. 1). It contains delicate mechanism for releasing the bomb, but its principal function is to hold the bomb snugly to the wing of the ship until it is ready for release. It is also used to hold 1000-lb. tanks of gasoline being ferried from one place to another in noncombat duty or needed to supply the extra fuel required by the plane when flying great distances.

Metal inserts are used at every attachment point to fasten the bomb rack to the wing structure, and there is a metal bushing through each leg to reduce the bearing pressure at the sway braces. Laminated phenolic strips are molded into the legs because this is where the greatest strain occurs, should the bomb sway in or out. The plastic body of the rack and its inserts not only support the vertical loads produced by the bomb but all sideway which falls directly upon the plastic legs. If dead loads were all the bomb rack had to support there wouldn't be much to write about, but dead loads are not figured in reckoning the structural requirements of this plastic part. A 500-lb. bomb becomes a 1000-lb. load, or more, when the ship climbs rapidly at an angle of 50 to 60 degrees. A gust of air which drops the ship suddenly or raises it a thousand feet without warning, may increase the vertical load by a factor of seven. In other words, the bomb rack and its fastenings must be designed not to take a load of 500 lb. (the weight of the bomb) but for a load of 3500 pounds.

The drag load in a dive may equal the weight of the bomb. This load is partially absorbed by the metal fastenings which

hold the bomb rack to the frame, but considerable pressure is exerted on the slender legs of the rack due to the rotation about the lateral axis. Side loads are even more important and severe. As the Mustang weaves, dodges and rolls in combat, fighting its way through enemy craft to deliver its load, the 500-lb. bomb brings side pressure on these slender legs equal to 1000 lb. or more.

These loads approximate combat conditions, but in engineering the design they are not enough. Aircraft engineers, being meticulous realists, set up design specifications calling for an additional 100 percent overload test which adds up to 7000-lb. vertical load, 3000-lb. drag load and 2000-lb. side load. They recognize that pursuit ships and dive bombers starting out on a day's chores are not taking a pleasure drive to the beach. They may encounter conditions that cannot possibly be foreseen. They may meet superhuman obstacles which must be overcome. In addition to the enemy craft which they must eliminate or avoid, weather conditions have to be met. Air gusts cannot be measured or estimated in advance of each trip. Sudden storms are bound to be encountered from time to time. Whatever happens, the ship must not fail. Just to be safe, 100 percent overload capacity is built into the design, and the plastic bomb rack has withstood these tests.

Why plastics?

The answer to this question goes back to 1942 when American aircraft were not so plentiful in foreign combat as they are today. It was decided to double the efficiency of the planes we had and to equip Mustangs with external bomb racks which they had never carried before. Aluminum was scarce. So was magnesium. At the time, concerns casting these materials had about all they could do with current war orders. Quick deliveries could not be promised. Also, there are 19 hr. of machining time required to finish a magnesium casting or equivalent section. This time is wholly saved by using the plastic molded part. Weight is important, too. The plastic rack weighs $1^{8}/_{10}$ lb. less than its magnesium counterpart—a saving of $3^{6}/_{10}$ lb. in weight per ship. The plastic rack is almost 7 lb. lighter than it would be in aluminum, and it is somewhat cheaper to build. Besides these obvious advantages, the plastic rack presents no problems of corrosion, and its surface is not easily scratched. Combat operations frequently take place over the ocean where salt air causes many materials to corrode. Magnesium will corrode if its surface becomes scratched, but not plastics.

The molding job was a difficult one. Molding inserts into a complicated part of this nature when canvas-filled phenolics are used is no easy task. Undercuts, slots and holes in the aerodynamic design—each presented a difficult engineering problem that had to be overcome in designing the mold. Laying in strips of laminated canvas to strengthen the legs intensified the problems. Furthermore, a 7-lb. casting with a variety of wall thicknesses requires careful cure if strength is to be maintained throughout the part.

Macerated canvas-filled phenolic was chosen for the rack because of its impact strength and shock-resisting characteristics. However, these properties alone were not considered sufficient to resist bending stresses likely to develop in the legs of the rack. Consequently, thick strips of laminated phenolic were used as inserts to strengthen these parts. The canvas-filled material will flow in the molding operation and, while the laminated phenolic inserts will not flow, there is a natural affinity between the materials so that they become homogenous when enough heat is applied. Greater stress strength is achieved in this way than by using metal inserts especially where no threads are encountered. However, metal attachment inserts are necessary at other points and were molded into the rack in the beginning. Since then it

1—This view of the inside of the bomb rack housing shows the points at which it is attached to the ship. 2—The 4 legs shown in this outside view of the rack are capable of supporting a 500-lb. bomb or jettison gasoline tank

ALL PHOTOS, COURTESY NORTH AMERICAN AVIATION, INC.

1

2

has been determined that comparable results are obtained and the molding cycle shortened somewhat by machining them into the molded part.

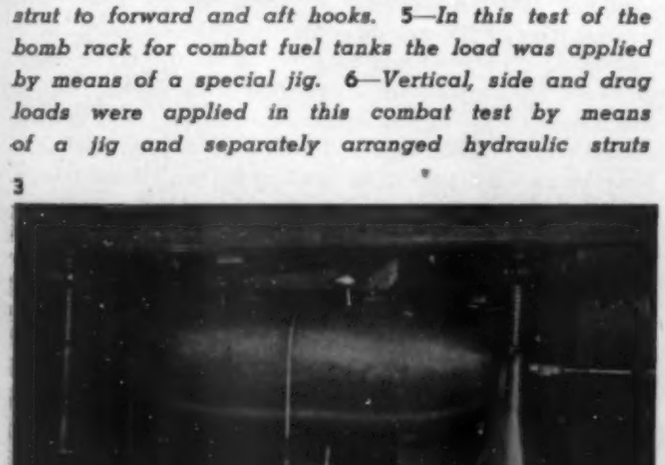
When the bomb rack was originally planned it was thought that plastics molding might offer the quickest method of getting into production—but it didn't. The mold presented difficulties that could not be foreseen. The first parts to come from the mold failed. They didn't have the strength which engineers thought necessary to meet all conditions of load. They failed, however, at 160 percent of ultimate requirements which wasn't bad considering that 200 percent was the goal. Their performance was good enough to encourage further work, and after some mold design revisions were made, production molds were built. Meanwhile, as with everything else in aircraft production, speed was paramount. A magnesium rack was designed and built. It was the first to go into foreign service. Today there are many more plastic racks than there are magnesium, and the army is well pleased with the way they perform.

The Mustang bomb rack was not designed with beauty in mind. Because of its peculiar shape the engineers dubbed it "the stuffed pig." Every dimension was carefully planned to carry a predetermined load without an ounce of surplus weight. Stress analysis was made of various materials before they were specified. Every line, every hole and slot, every insert was placed with the optimum engineering advantage in mind. All exposed surfaces are curved to reduce drag. Furthermore, the design was planned exclusively for plastics and is unlike the design for the magnesium rack in several respects.

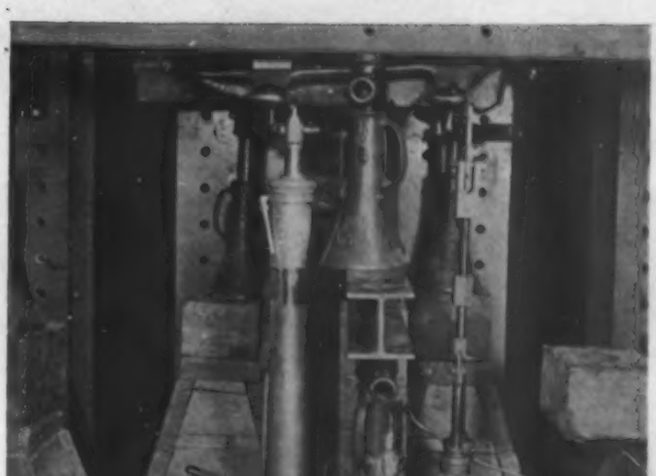
Most interesting angle of the development, perhaps, is the torture-chamber methods used by the aircraft engineers to test every factor of behavior under repeated loadings. Probably no more complete stress analysis could be made to predetermine any possible failures of the part under combat service conditions. With (*Please turn to page 170*)

3—In this set-up for testing the bomb rack for bomb loads, vertical, side and drag loads were applied to a 500-lb. bomb casing in the rack with screw jacks and hydraulic pressure. 4—The load in this set-up for testing ferry tank loads, was applied by attaching a vertical hydraulic strut to forward and aft hooks. 5—In this test of the bomb rack for combat fuel tanks the load was applied by means of a special jig. 6—Vertical, side and drag loads were applied in this combat test by means of a jig and separately arranged hydraulic struts

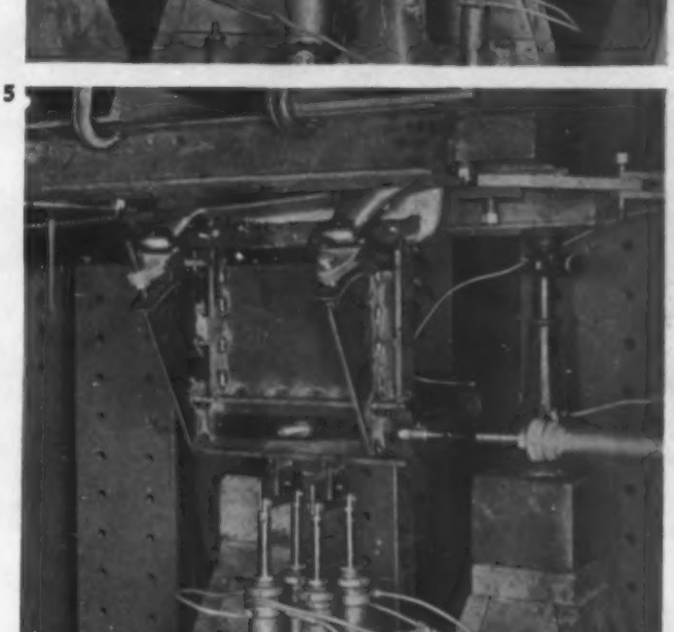
3



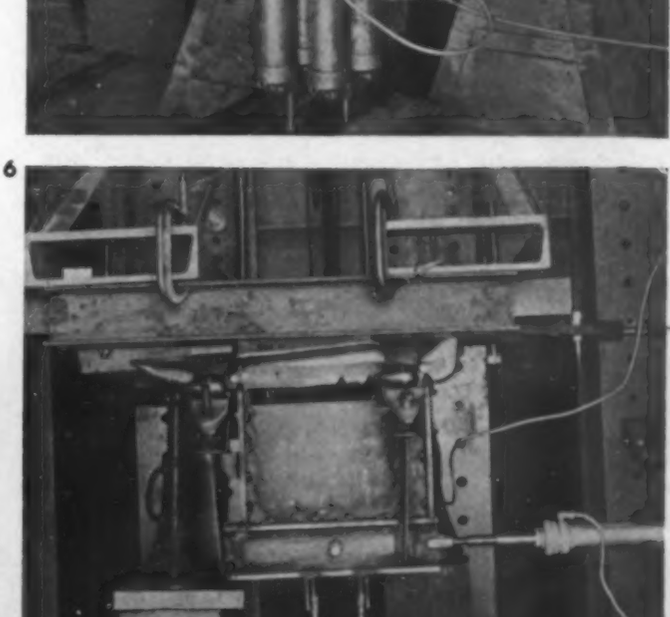
4



5



6



Resin-bonded marine bearings

ALL PHOTOS, COURTESY JOSEPH T. RYERSON & SONS, INC.

A resin-bonded stave bearing of the new design being installed in the stern tube of an ocean-going tug. Tolerances in this bearing were held to a minimum with allowance for only a nominal material swelling

AT the outset of the war it became evident that available supplies of traditional bearing materials—metals, rubber and lignum vitae—would not be sufficient to meet the needs of America's vast shipbuilding program. Faced with an immediate demand for ships, naval architects and marine designers turned to resin-bonded bearings to do the job. The term "resin-bonded" refers to resin-impregnated cotton fabric laminated and molded under heat and pressure into any desired shape. Now, after a period of initial development, these bearings have outgrown the "wartime expedient" class and have become standard equipment because of outstanding performance.

Because of the satisfactory performance of resin-bonded stave-type bearings in early tests and replacement installations on various vessels, the old conventional stave pattern for stern tubes and other marine applications was retained in the greatly stepped-up shipbuilding program. The resin-bonded material offers many advantages such as longer life, lower coefficient of friction, natural water lubrication (either fresh or salt), inertia to chemical actions and absence of storage problem. Generally it makes an all-around stronger and more satisfactory bearing material. However, the old conventional stave design with staves jammed in tightly, made no allowance for circumferential swelling. As a result, when the material absorbed water after a short period of service, a so-called "swelling" developed which in some cases resulted in the bearing seizing the shaft.

A careful investigation of the whole "swelling" problem was conducted by the engineers of one company, who ran preliminary tests on resin-bonded blocks of many different sizes (Fig. 1). They found that the erroneously named "swelling" in a conventional stave bearing was created by a combination of 2 factors. Of minor importance was a natural moisture absorption by the resin-bonded material which produced a nominal swelling of material, easily predetermined and controlled through proper running clearance. The major factor was stave distortion or buckling, an action created by combined material swelling pressures which exert their greatest force at the outside perimeter of the staves. These combined pressures squeeze the staves at the tips of the outer perimeter thus setting up a condition of off-center loading which causes buckling and seizure of the shaft. This action, illustrated by the exaggerated drawing in Fig. 3, takes place because the amount of swelling is proportional to the width, and the width of the stave at the outside perimeter is greater than at any point closer to the center on the contact surfaces.

As more and more resin-bonded bearings went to sea and the "swelling-distortion" problem became more evident, numerous unsuccessful attempts were made to overcome the trouble. One difficulty lay in the fact that the troublesome staves were hidden in the bearing shell. Removal meant destruction of the staves and, therefore, destruction of all evidence of buckling. For this reason the trouble was continually referred to as "swelling." Staves were designed with recessed or notched backs, but these merely accentuated the buckling and offered poorly backed-up bearing surfaces. Water grooves were changed. But all these staves retained the same fault in that they did not relieve the problem of maximum swelling at the circumference as compared to other

points on the stave closer to the center of the bearing. Greater running clearances merely fostered unnecessary vibration and pounding. Figure 4 shows cross-section end views of some of these unsuccessful designs.

The stave design finally adopted by this company after extended tests, differs from the conventional stave in one respect—it makes allowance for circumferential swelling which is proportional to the width and is greatest, therefore, at the outside perimeter of the staves. These staves are so constructed that their abutting surfaces only contact at a point above the center of mass of the stave. Any circumferential swelling (Fig. 5) merely tends to seat the bearing more perfectly in the shell. Bearings using these staves offer proper running clearance commensurate with water lubrication, a very nominal material swelling, smooth operation, 100 percent effective bearing surface adequately backed up and longer bearing life with freedom from buckling.

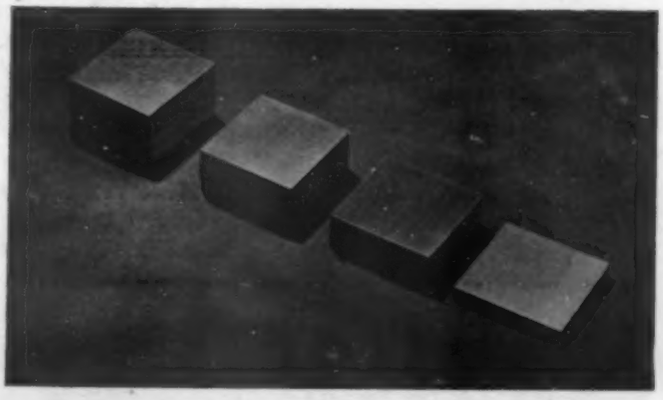
The old design with staves fitted snugly against each other makes no allowance for the material swelling at right angles to the laminations. When the bearing is submerged the staves naturally absorb moisture and swell in proportion to their width of section. Since the greatest stave width is at the outer perimeter where it contacts the bearing shell, the greatest swelling pressures also occur there. In effect, this swelling creates a condition of unbalanced loading which causes the stave to buckle.

Figure 2 shows a cross section of a marine bearing in which the old conventional staves are used in the top half and the new design in the lower section. As can be seen, the old design makes no allowance for the material swelling at right angles to the laminations after submersion. As a result the staves buckle inward toward the shaft and leave the bearing surface unsupported. The new staves have the contacting surfaces between the staves relieved. This produces a condition of unbalanced loading which is the reverse of that encountered in the conventional stave design. Consequently the staves can only seat themselves more firmly.

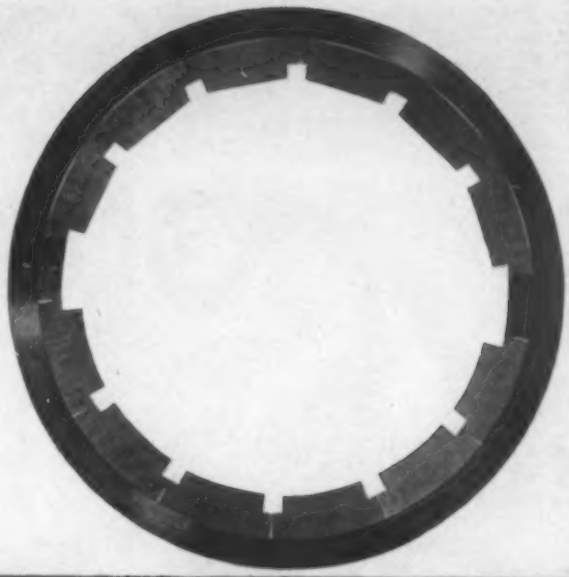
Credits—Material: Ryertex, registered trademark of Joseph T. Ryerson & Sons, Inc., for bearings manufactured of material supplied by Continental-Diamond Fibre Co.

1—In developing the new stave design, swelling tests were made on various sizes of resin-bonded blocks submerged and measured at regular intervals. 2—This cross section of a bearing illustrates (at top) the distortion occurring with the old staves and (below) the absence of swelling with the new design. 3—An exaggerated drawing of a conventional stave showing how pressures on the outside perimeter cause buckling and seizing. 4—Cross section end view of unsuccessful staves. 5—Diagram showing forces and swelling action of the new stave design

1

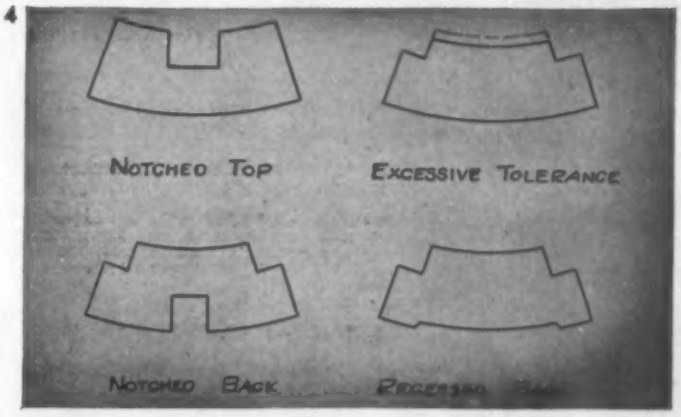


2

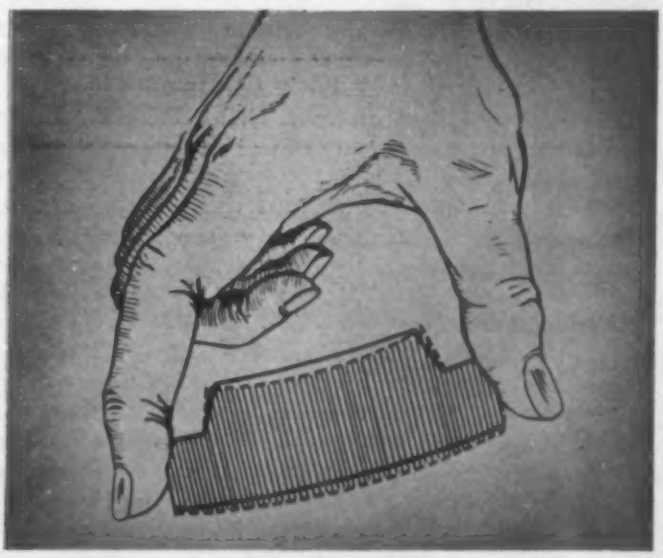


3

4



5



ALL PHOTOS. COURTESY METRO-GOLDWYN-MAYER PICTURES

1—*Appearance of patient's ear after surgery*

2—*This same ear showing vinyl restoration*

Supplementing surgery with vinyls

by E. F. LOUGEE*

This story is presented purely in the interests of scientific investigation of ways and means to aid Naval casualties, mitigate disfigurement and restore morale. Readers with laboratory experience in similar experimental work or with ideas which may be developed in this humanitarian undertaking, are urgently requested to communicate with Jack Dawn, chief of Make-Up Division, M. G. M. Studios, Culver City, Calif. The service is entirely voluntary and no compensation is paid.

STUDIO make-up technique and vinyl plastics are expected to relieve a good deal of the temporary mental anguish suffered by hospitalized naval patients who find themselves disfigured in combat. U. S. Naval surgery is of the highest order with many of the nation's finest surgeons on its staffs, but when a man's eyes, ears and mouth are burned so badly they no longer function, skin grafting and subsequent operations with interim periods of healing require a long time and many months may pass before anything like normal appearance can be restored. When a man's nose or jaw is shot away plastic surgery usually can restore the face, but several operations, weeks or months apart, may be required during which time the patient prefers to remain in seclusion—out of sight of his friends. With an earnest wish to mitigate this period of embarrassment, M. G. M.'s Make-Up Chief, Jack Dawn, has turned his talents and his knowledge of plastics to devising a method of self-restoration.

Ever since vinyl plastics became available Mr. Dawn has used them to make mobile masks. He has used them to change facial contours to his liking, to make the old look young, to make the young look old and to bring racial characteristics into faces where they never existed before. He has found that for his work in pictures vinyls possess the best properties of any of the plastics and believes they are nearly ideal for prosthesis to restore morale. One of the essential qualities of any artificial member to be attached to the human body is natural appearance. It must cling securely to the surface of the skin and be sufficiently mobile to function naturally when the adjacent skin moves. When applied to the human face, it must be thin enough to flex visibly when face muscles move, especially around the eyes and mouth. The muscles around the eyes have more delicate expression and are more sensitive than are muscles in other parts of the face. The plastic must be of the right consistency to look and "act" like natural tissue. Since the line of attachment must blend, pigmentation is of importance.

Being a clear plastic with rubber-like qualities, vinyl accepts pigmentation readily but depends upon the skill of the artist and sculptor to give it lifelike color and form. The pigmentation of human skin varies widely. No two people are exactly alike. While there is a basic color for white skin areas, pores, arteries and veins alter this basic color in other areas. There is natural shading around the eyes quite different in pigmentation from the flush on a cheek. All these conditions must be reckoned with in preparing the vinyl materials. Years of experience have given Mr. Dawn a knack of blending pigments in plastics so they cannot be distinguished from natural skin. His methods are a secret except to the Navy, but he has revealed that he mixes his colors with the solvent of the material he is using and by careful choice of pigments employed can match any

* Plastics Institute.

3

3—Smoothing the surface of a 2-piece mold in which the pigmented vinyl nose, eyelid and cheek will be formed

type or color of skin. His manner of plasticizing vinyl resins to make them resilient enough to respond to delicate flexing of face muscles has taken years to develop. It is evident to those who have seen M. G. M. close-ups on the screen that he has taken every advantage of the natural properties of vinyls and given them unique characteristics of his own invention. Mr. Dawn cites as an example Spencer Tracy in "Edison, the man," wherein Tracy, a much younger man than Edison, so closely resembled the old gentleman through make-up that many people were mislead to believe that the close-ups of Edison were taken from old newsreel shots. He also points out that in the picture "Madame Curie," Greer Garson was made into an 80-year old woman through the use of plastics alone.

Now Mr. Dawn has volunteered to teach commissioned naval medical officers his methods of modeling and pigmenting plastics for cosmetic surgery, and he devotes every moment of his spare time to working with them in a special laboratory at the studio. He instructs these officers in the fine art of modeling human features, mold making and preparation of the plastic material.

The procedure in restoring a facial injury is to make a plaster of Paris mask direct from the patient's face. This mask is taken to the laboratory where missing features are rebuilt with modeling clay. Let us assume for sake of explanation that the missing member is a nose. A new nose is modeled in clay directly against the patient's mask which gives it a perfect base. Every detail of irregularity in the mask will be reproduced in the base of the modeled member so that the replacement, when it is made, will be in close contact at every point on the patient's face. A 2-piece plaster of Paris mold is made from the clay model. The vinyl preparation, pigmented to match the skin of the patient, is worked into the plaster mold, pressed and air dried until it "sets." When removed from the mold this replacement member need only to be brushed at the base with alcohol and applied to the patient's face. The alcohol serves as a solvent to make the base of the member a trifle soft and tacky, and the plastic becomes its own adhesive as the alcohol evaporates away. No gums or other adhesives are necessary in this method, and it takes a lot of pulling to make it let go. Face powder (*Please turn to page 168*)

4 5

6 7

8 9

These photographs show the initial results of the process. 4—The patient after surgery has done what it can. 5—Here a vinyl mask hides many of the scars and permits normal function of eyes, nose and mouth. 6 and 7—The left side of the face without and with the mask. 8 and 9—Here the right side is shown without and with mask

Army matchbox

At military training centers in this country and at posts behind the lines, an extra folder of paper matches always can be obtained at the canteen. But when troops go into action against the enemy, there is no returning for another packet. For such emergencies the Army has adopted these individual olive-drab plastic match boxes. A cord gasket in the cap makes the case waterproof while the piece of sparking pyrophoric metal in the bottom emits a good spark when struck with a piece of steel—enabling the soldier to start a fire after all 20 wooden matches have been used.

These boxes are molded of cellulose acetate butyrate, 2 cases and 2 caps to a shot. One of the principal problems in producing the mold, the hobbing of the very deep cavities, was solved by putting a point on the hobb and boring holes in the block into which the hobb was pressed at different depths. Holding the pyrophoric metal pieces in the mold while the machine was closing also presented difficulties since a horizontal press was employed. The solution to this problem lay in making the bottom of the cavity movable by attaching it to a rod which moves with the ejector plate. Metal pieces are placed in the mold by hand and are held in that position by a small amount of adhesive cement. Made with heavy raised ribs so that a person wearing winter mittens can remove the cap, these boxes are produced at the rate of approximately 150 per hour.

Credits—Material: Tenite II. Molded by F. J. Kirk Molding Co. for U. S. Army

PRODUCT

Jungle "water wings"

Tradition has placed the Army Engineer Corps always ahead of our advancing troops, building bridges, laying roads, assuring the swift and easy advance of our fighting men. But there are occasions when our troops are thrust far ahead of the building crews, when only months of labor could bridge the numberless swollen streams and fill the endless miles of treacherous swamp. To protect our jungle fighters under these circumstances when a single misstep might plunge them into water over their heads, the Army provides "water wings" made from cotton and vinyl acetal.

These flotation bladders as they are termed officially, consist of 2 separate envelopes about the size of a squared football bladder. In making the individual bags, 2 oblongs of cotton fabric combined with vinyl acetal are placed together fabric side out. These envelopes then are heat-sealed around all 4 sides except for a small opening left for the insertion of a short piece of rubber tubing which serves as the inflation valve. The twin bags when not in use are customarily carried folded in the soldier's pack. Inflated for use as water wings the envelopes are tucked under the trooper's arm pits beneath his blouse.

Credits—Material: Saflex. Fabricated for the U. S. Army

Red box on the corner

Fire-fighters and a fire-conscious public justly demand adequate fire protection—and this means dependable equipment. Since 1917 molded phenolics have played their part in auxiliary fire alarm sets in rendering just such service. On the strength of early routine tests and because of continued excellent service performance under actual fire conditions, permanent use of plastics in this industry is guaranteed.

The three molded plastic parts shown in the accompanying illustration are the insulating holder, base plate and movement mounting base. The black phenolic holder which secures a metal-encased mercury contact tube, is compression molded in a 2-cavity die. The holder has a stainless steel shaft insert to which the outer operating handle is secured at assembly. The red phenolic base plate on which the plastic holder is mounted, has 4 brass inserts serving as wiring terminals and one stainless steel insert securing the other end of the restoring spring. As in the case of the holder, it is compression molded at a temperature of 310° F. under 50 tons' pressure for $2^1/_2$ minutes. The raised key-way is made by means of a depression in the mold. The black phenolic movement mounting base has 12 molded-in inserts. Three are stainless steel studs while the remaining 9 are brass. The molding time is 3 min. under 50 tons' pressure at a temperature of 318° F. This piece serves the purpose of mechanically securing and insulating the movement mechanism.

Credits—Material: Bakelite. Molded by W. M. Gulliksen Manufacturing Co. for the Gamewell Co.

DEVELOPMENT

Powdered soap dispenser

Women are leaving the home for war jobs. Men are transferring from "white collar" to factory positions. Everywhere people are digging into the grease and dirt that must accompany any mechanical employment. As a result, soap and soap dispensers stand high on the list of musts.

Except for a few fastening screws and bolts this powdered soap dispenser is made entirely of cellulose acetate. Its transparent cover allows easy inspection of the contents and prevents dust and foreign articles from dropping into the unit. An ivory grill which rests immediately beneath the cover is molded with cross bars to prevent theft of the soap and tampering. An ingenious arrangement of transparent filters which can be seen in the center of the accompanying photograph is operated by a finger lever to dispense a predetermined amount of soap—a protection against waste.

The body of the dispenser is molded in a one-cavity die while a second die produces the transparent cover and all the parts that make up the dispenser unit. The ivory mounting bracket, top ring and lever knob which are the only remaining plastic parts, are molded in a third die.

Credits—Material: Lumarith. Molded by Gits Molding Corp. for the West Disinfecting Co.

Industrial applications of phenolic resins

THE quitting whistle had long before ceased echoing up and down the building. One by one the few remaining engineers reached a stopping place, arranged their work and slowly rolled the protecting black cloth cover over their drawing boards. But in the office of production planning at the Curtiss-Wright Corp.'s Buffalo plant, lights still burned brightly, for Planning Superintendent Del Anderson was seeking a solution to a baffling problem.

Materials were hard to get—materials desperately needed for additional tooling in the enormous plant. The Army was calling for more and more giant cargo-carrying Commandos. Production schedules were being stepped up to meet this demand. Would the supply situation improve or become increasingly difficult? What about materials for the immediate future? What about long-range planning? Such was the problem confronting Del Anderson—a problem which had to be solved if production was to reach the point demanded by the Army.

If only there were more steel! Steel was the problem all right. It was used for so many things. After all, wasn't this the age of steel? And if this was the Age of Steel, what next? Would it be called the Age of Alloys? Or might it be Plastics? Plastics were being used for so many things and in so many ways—new ones every day. Yes, that would be it. The Age of Plastics!

The "Age of Plastics" idea intrigued Del Anderson. Perhaps here was an answer to at least a part of his problem. Perhaps it would be possible to replace some of the hard-to-get materials used in the tooling with a suitable plastic! Next day the idea seemed even better than it did the night before, and the decision was reached to establish a Plastic Tooling Division.

To say, "We will establish a Plastic Tooling Division" is one thing, but to find the man to take charge of such an undertaking is definitely another. If the project was to be developed along such lines as had been planned, a man was needed with a broad experience in the plastic field, with practical ability and vision. As a result of persistent and intensive inquiry, Harold "Doc" Clark came to supervise development work which has centered about the industrial applications of phenolic resins as an aid to manufacturing.

Since the field of resins is so new, it was felt that an intensive study of the mechanical properties and physical characteristics of all available materials would be essential to a sound beginning. Ten intensive months of research and test with the cooperation of the Production and Tooling

ALL PHOTOS, COURTESY CURTISS-WRIGHT CORP.

1

2

1—Two cast thermosetting plastic test beams measuring 5 ft. long, one of which was reinforced with tubing. Subjected to static test, the reinforced beam withstood more than twice the load carried by the plain phenolic beam before fracture. **2**—*The character of the fractures in these two beams indicate the effect of the reinforcing tubing in distributing the static load*

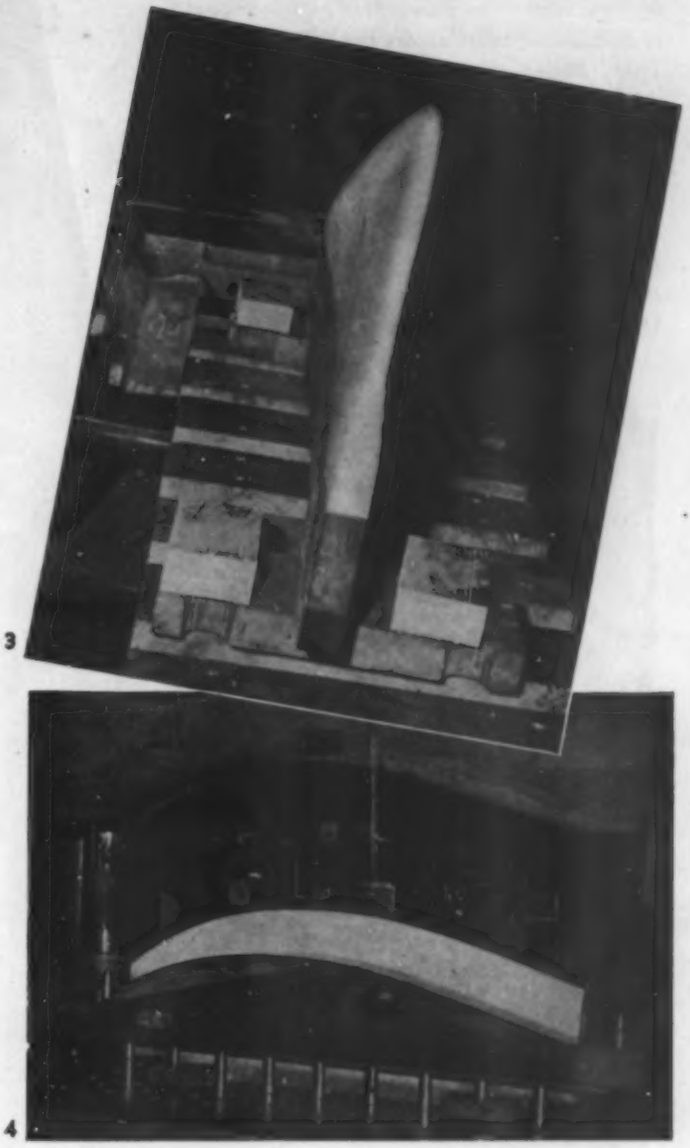
Department has provided the background for the many original and outstanding applications developed and in use at this airplane factory. During this period, every known type of phenolic thermosetting resin applicable to industrial use was tested and charted. These tests included testing for shear, tensile strength and compressibility. The materials having the best all around qualifications were selected, and the actual tests for application were begun.

Those connected with the experiments reasoned that if concrete could be strengthened by imbedding steel reinforcing bars, why not a test beam similarly reinforced, cast of thermosetting plastic? In keeping with the trend toward lightweight construction, 6 metal tubes were used rather than solid bars. Two test beams were cast in the same mold—one with reinforcing tubes and one without. Since varying rates of expansion can create major problems, the beams were subjected to a series of tests to learn if the reinforced beam would be affected by sudden temperature variations. Both beams were placed in a refrigerator maintained at 50° F. for 10 hr., removed to a steam vat where they were left long enough to assume a uniform cross-sectional temperature, then plunged into a tank of cold water. Placed immediately in a static test machine, they were loaded to destruction. The reinforced beam required more than twice the load for fracture than did the plain beam (Figs. 1 and 2). From this and subsequent tests, knowledge was gained of the method for handling the combination of plastic and metal which has proved so valuable in recent developments.

Armed with an accurate knowledge of the available materials and a limited handling technique acquired during the tests, the Production Planning Department surveyed the situation to learn where this material first could be used as a proving ground. More than 18 years ago, the Curtiss Aeroplane Co. experimented with the use of draw dies in producing airplane parts. Through the intervening years they have improved this production method until its use has been a vital factor in supplying the armed forces with training, fighter and cargo airplanes—in volume. Reviewing the situation it was apparent that there still were some undesirable features in both the punches made of metal and also those made of wood.

When using a metal punch on a deep draw, the aluminum sheet has a tendency to adhere to the punch with consequent uneven stretching of the metal over the form. Wrinkling and rupturing of the part frequently results, this condition can be overcome by using progressive draws, but deep forming in a single draw is not too successful. Draw die punches made of wood are superior in many ways to those made of metal. The lubricated wooden working face provides a slippery surface over which the metal stretches more evenly and with less wrinkles. The punches' greatest weakness is that they are unstable in changing atmospheric conditions. After it has been unused for any length of time it often has been necessary to have the punch reworked to reestablish its accurate size and contour. One characteristic of both metal and wooden punches when making deep draws is the "orange peel" effect which they produce.

These draw dies looked like a practical place to begin and, accordingly, a test punch for one of the cowl skins was make. The results were so outstanding that draw dies with plastic punches now are a familiar sight in the hydraulic press department, and each passing week sees metal and wood being superseded by these thermosetting resins. The mirror-like plastic surface has an additional slippery quality which is not present even in the lubricated wooden punches and



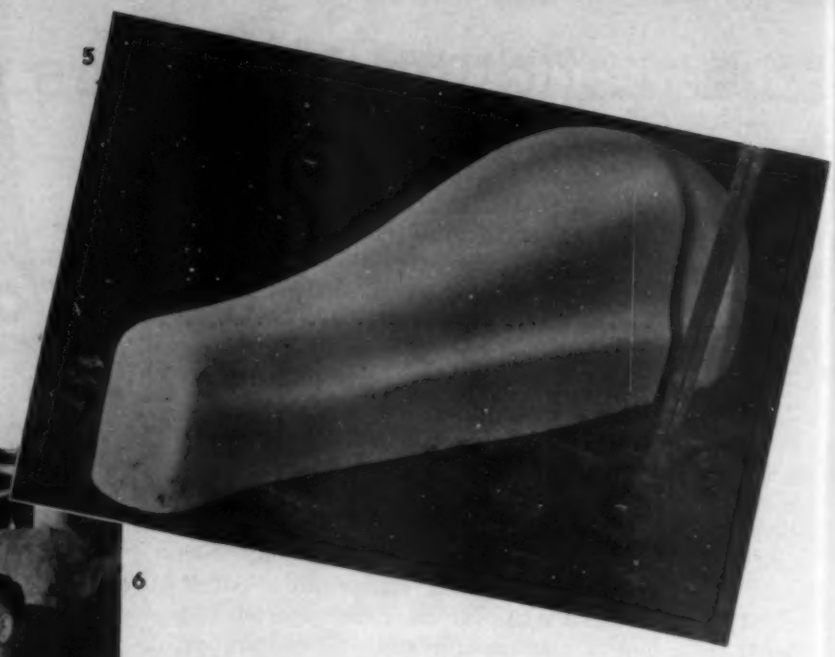
3—A wing tip punch of cast phenolic viewed from the end to show the 8-in. deep draw which these parts require. The wood blocking to which the plastic is bonded elevates the punch to the correct working height. 4—This plastic wing tip draw die mounted in the hydraulic press surrounded by the clamping frame, is ready for operation. During the forming process the clamping frame depresses while still holding the metal taut, stretching the metal over the phenolic punch so as to form a smooth, even part

makes possible the deep drawing of difficult parts like wing tips (Fig. 3 and 4) in a single stroke of the hydraulic press. Early tests brought to light an interesting fact. Punches made from certain resins contained ingredients which caused microscopic deterioration of the aluminum alloy sheet which had been formed over it. For this reason new applications with new materials always are studied to make sure that no such deterioration can result.

Typical of the difficult work being formed by these plastic punches is a part of the air scoop in the cooling cowl of the P-40 Warhawk. In addition to a deep draw, difficult in itself, this scoop combines a concave section to provide clearance for other equipment in the tightly packed cooling cowl (Fig. 5). Previously produced with the aid of rubber

5—This view of an unmounted punch of cast thermosetting resin shows the concave area. The concave section is formed by contact with a mating die at the end of the hydraulic stroke. 6—The underside of the plastic working face of a punch for producing cowl skins illustrates the manner and extent of coring to reduce the volume of resin required in making the cast. 7—The surface of the die can be altered to compensate for spring-back through use of wood-working tools

ALL PHOTOS, COURTESY CURTISS-WRIGHT CORP.



5

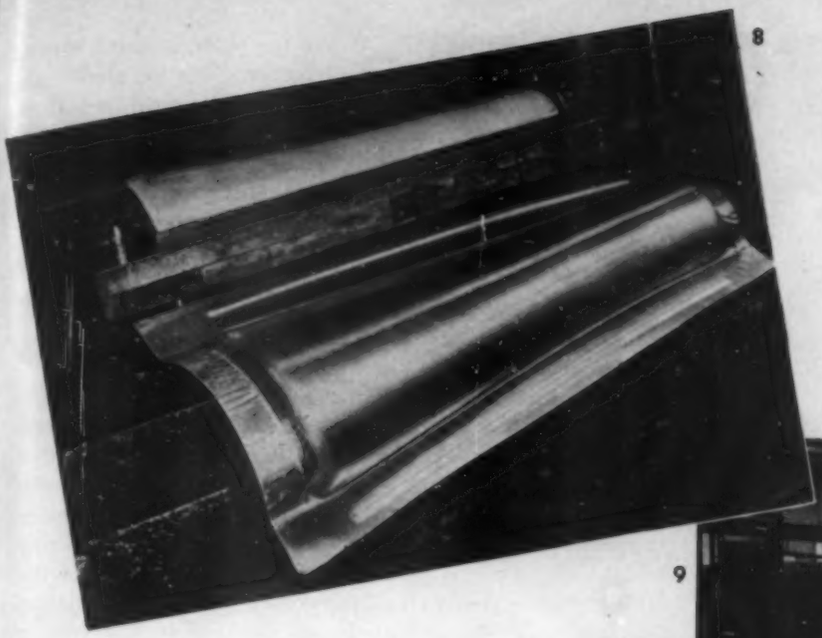
6

7

pads on the hydraulic presses and on the drop hammers, these parts could be held only to rough dimensions and required laborious hand work to bring them to their final form. Ruptured parts were frequent, and only by concerted effort was it possible to keep these scoops flowing to the production lines. The plastic punch has changed all that. In a matter of 2 shifts, it now is possible to produce a volume of scoops which would have required more than a week by methods previously in use.

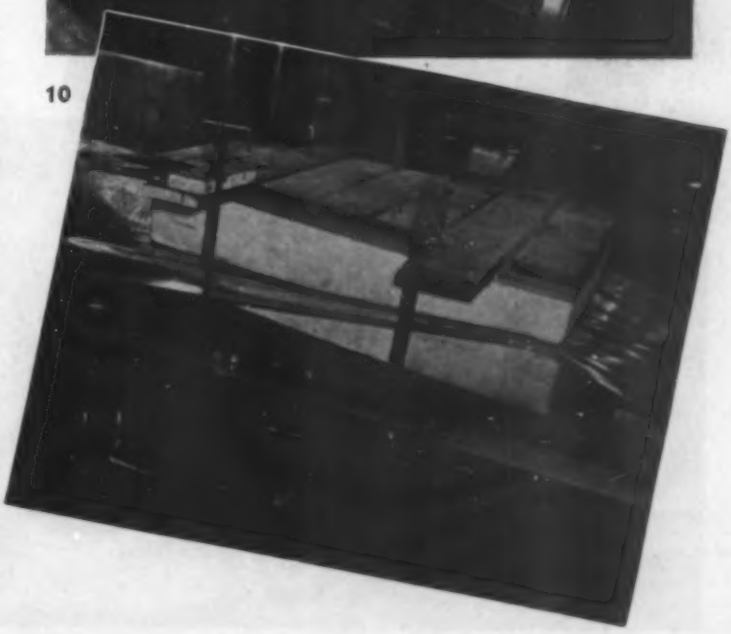
In addition to the superior quality of the work produced with the plastic punches, "orange peel" effect is not present when making parts requiring a deep draw. Also, the stable nature of the punches saves many hours of rework which were necessary to keep wooden punches in accurate form. With the first small test phenolic punch, working experience began accumulating which has made possible a steady increase in punch size. Now they are being used in the production of large cowl skins for the cargo-carrying Commandos. Only the working faces are made of the thermosetting resin, cored to conserve material (Fig. 6). The use of broken and sized scrap phenolic for "loading" these large castings has proven wholly satisfactory. Punches which are not needed are reclaimed 100 percent by this method, reducing the amount of new resin required. The curing process blends the entire cast into one homogeneous mass and while the working face has the appearance of a patchwork quilt, it is comparable in strength to a cast of virgin material. The backing of these working faces still is constructed of wood, the first layer being bonded to the face with a coating of phenolic. After curing, this bond is so strong that the backing has become an inseparable part of the phenolic face. The additional blocking to obtain the correct working height of the punch then is screw-mounted to this first layer.

Questions frequently are asked concerning breakage. Before the "know how" had been developed to its present point, one of the early punches cracked. Salvaging 80 percent of the thermosetting working face, this punch was reworked and put back in service. Photographed after the completion of an 800 run (Fig. 8), the repaired punch showed no sign of wear or weakness. Small surface cracks or mutilations can be repaired easily, thus restoring the working face of the punch to its original condition. Much of the progress in this plastic punch development has been due to the coopera-



8

9



10

8—Because the technique of coring had not been perfected, this draw die fractured. Here it has been returned to service after repairs. **9**—*With the top phenolic die in a raised position, the mild curvature of the sheet can be seen. The mottled effect in the plastic is caused by broken pieces of reclaimed phenolic used to load the casting.* **10**—*Side view of the experimental set-up of the first application of plastic male and female dies to the stretch press*

tion of a large material manufacturer whose laboratories and chemists produced new resins to meet specific conditions and new accelerators to reduce the curing time.

Considering themselves "over the hump" on draw die applications, the Production Planning Department next tackled an unusual problem concerning a new application of the stretch press. One of the fuselage parts for the Commando, called a "transition skin," was being produced on power hammers and when made in this manner required 4 hours per skin. The contours were gentle but complicated by a reverse curvature and the fact that the part was made of "ST" Alclad stock which is in full-hard condition. These factors ruled out its production on the stretch press by stretching alone. The idea of using male and female dies was conceived and given a test. Looking like an enormous lettuce sandwich, the aluminum sheet is stretched between these 2 forms which are clamped tightly together (Figs. 9 and 10). The stretch of the material *plus* the pressure does the trick. Even with this experimental setup—admittedly crude—a perfectly formed part every 15 min. is sufficient evidence to convince the most skeptical. The pictures of this operation are not presented as a finished production method but rather as an experimental test—the results of which surprised everyone. Since this is the first time such a die has been made, it also will undergo substantial changes to conserve material. Proper devices for handling the upper die now are being worked out and adapted to production. Estimates indicate that a production cycle of approximately 3 min. will be possible when the work is completed. Thermosetting resin, loaded with reclaimed phenolic, has given the stretch press another production application.

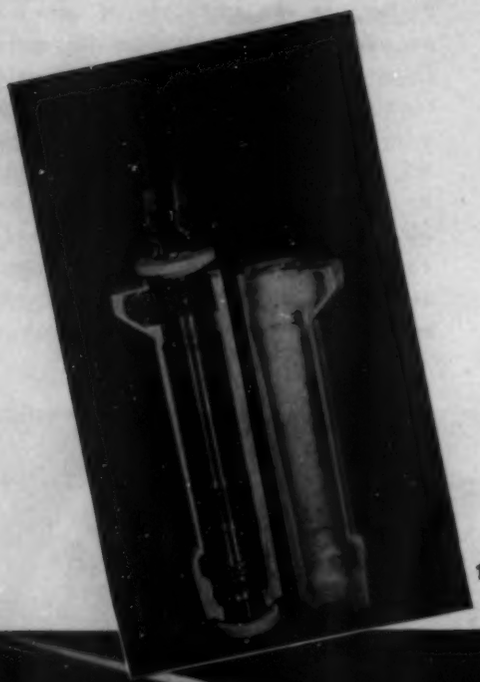
The ease with which the punches may be cast is an important factor of this phenolic material. Wooden punches now giving accurate results may easily be reproduced in cast phenolic—a stable material which assures that even after prolonged storage the first part off the press will be accurate. In making these phenolic reproductions of wood dies an interesting fact has been discovered. The slippery plastic surface reduces the friction of the draw so that while a wooden punch may produce accurate parts, an exact reproduction in thermosetting resin probably will require slight alterations to offset the changed springback.

In addition to their use in actual forming production,

there is still another adaptation of the phenolic resins where they serve as an adjunct to production. Plating shields of this material are speeding the output of chromium-plated parts in the Electroplating Department. More efficient and economical, more easily assembled and removed, these lightweight durable plastic shields have effectively reduced the former costly and not too secure method of tape and lacquer stop-off. A time reduction of 76 percent over the former method of preparing the work for plating is the actual saving. In several cases actual plating time and electrical current consumption have been reduced and plating now can be controlled to within .001 in. of specified thickness.

The most extensive present use of these shields is on landing gear struts. Two types of shields have been made—one for shielding the outside of the barrel while plating the inside (Fig. 11) and the other for shielding the inside of the piston while plating the outside. The latter shield combines a phenolic cap into which has been cast a threaded steel ring (Fig. 12). This ring protects the external threads of the piston and serves as an effective stop-off during the plating operation. Production plating of identical parts involving masking will quickly write off the first cost of these shields. Cracked or broken shields may be repaired. When of no further use, the plastic may be reclaimed.

Not so spectacular but equally effective are the small plastic plating shields which combine the electrodes with the plastic receiving form (Fig. 13). By this arrangement the small part to be plated is placed over the electrode and in the plastic receiver. This method effectively stops the internal plating while assuring 100 percent external coverage. Since these shields have to withstand chromic acid, many resins were tested to secure the best available product for this application. Although the resins finally selected were altered slightly by com- *(Please turn to page 166)*



11

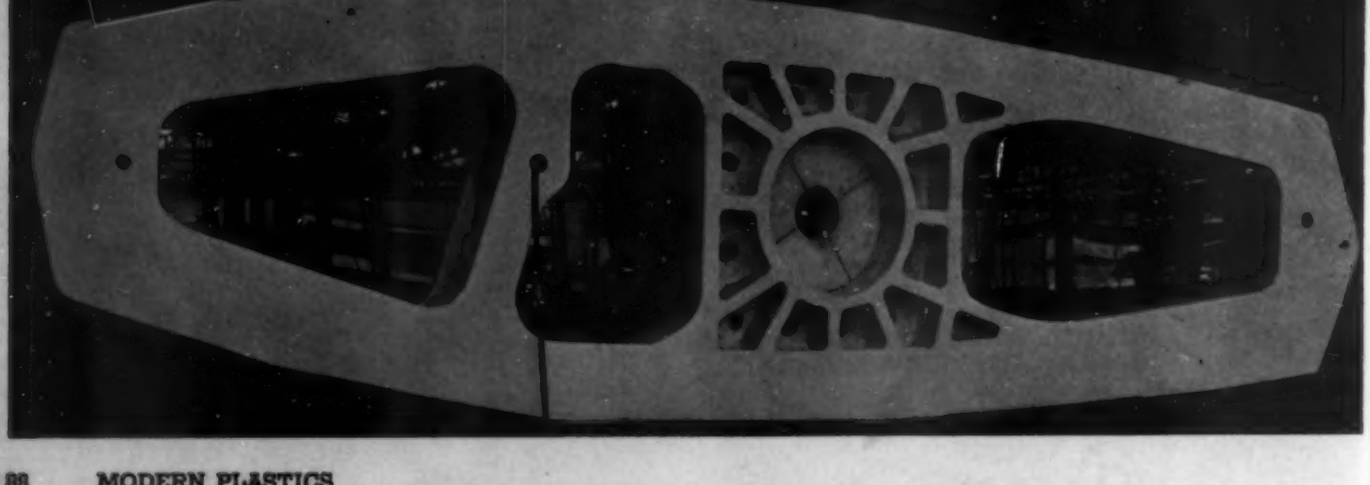
12

13

11—A strut inserted in half of the thermosetting plastic plating shell which protects the outside of the strut while the interior of the barrel is receiving the chrome plating. 12—A phenolic plating cap with cast-in metal ring which prevents the internal plating of the strut piston and protects the external threads during plating. 13—Multiple plating shield in which the electrodes are embedded in the plastic and connected to supporting hooks. 14—This experimental trunion plate which weighs about 1000 lb., is the largest industrial phenolic casting in the world

ALL PHOTOS, COURTESY CURTISS-WRIGHT CORP.

14



This utility cover for a new Flying Fortress life raft is coated with a synthetic resin composition. It is yellow on one side for rescue identification and dark blue on the other for camouflage purposes

OFFICIAL PHOTO, U. S. SIGNAL CORPS

Replacements for rubber coated fabrics

by A. F. SCHILDHAUER*

JUST prior to the war, the rubber-coated fabrics industry was confronted with the problem of reducing natural crude rubber consumption by at least 10 percent in order to build up the country's stock pile. This seemed to be a difficult problem at the time, but nothing in comparison to the one that developed a few days after war was declared when all crude rubber and mixed compounds were frozen. There was a general feeling that coated fabrics could be made with other materials although at the time no one knew just exactly how they were going to proceed with the work and what materials were to be used.

Reclaim and synthetic rubber

The first material that came to mind was reclaimed rubber which had been used in years past. A lot was known about its quality and processing, but no one had considered it by itself in formulating coating compositions. However, the first step was to have a little rubber allowed for use with the reclaim. Fabrics were soon being coated with compositions containing 4 to 5 parts of crude rubber instead of 25 to 40, and 40 to 50 parts of reclaim where none or up to 25 parts had been used before. This didn't last long. Soon no rubber at all could be allotted for most coated fabrics. Work then was done with all reclaim compounds. The coatings produced were only fair in quality, but under the circumstances, seemed to be pretty fine because it was the only material available with which there had been large-scale experience.

It was but natural that the industry look forward toward synthetic elastomers that had been on the market for some time. With about 10 years' experience in coating fabrics with Neoprene, one of the elastomers, many excellent constructions had been developed. In the emergency, therefore, it was used for all types of coatings, but it soon was allocated for only those items for which it was particularly adapted. It still is being used in these cases.

Some elastomers did not adapt themselves too well to the coated fabrics industry. The chief difficulty was that they had objectionable odors for such purposes as wearing apparel, food, water containers and other items with which people came in close contact. They processed fairly well but there were other factors which made them difficult to use. One of these was encountered in the fabricating of finished products where the cementing of the various seams presented a very serious problem.

Perbunan was coming along. It had been in manufacture for about a year and the industry had had several months' experience with it. Theoretically it was said to process about the same as Neoprene, but from practical experience this was not found to be so. The material was difficult to calender—being very dry. At first it could not be adhered to anything, particularly fabric, but after a little persistence it was found that by properly compounding, some coated fabrics could be produced from it that were fairly good. Later it was discovered that by mixing a small amount of rubber reclaim with Perbunan, it was possible to make satisfactory coated fabrics for such purposes as upholstery which at that time still was being used in fairly large quantities particularly by the Navy Department. It wasn't long before no more Perbunan and no more rubber reclaim were allocated for products of this type. Hycar was in the same category as Perbunan. It was being produced in fair quantities but was just as difficult to process. However, a small amount of coated fabric was produced with it, and at the present time it is being released for only those selected purposes where it is especially suitable because of its specific resistance characteristics.

(*Please turn to next page*)

* Technical Superintendent, Fabrikoid Div., E.I. du Pont de Nemours and Co., Inc.

Synthetic resins

The real volume of coated fabrics, particularly the Quartermaster Corps requirements for raincoats, could not be made from crude rubber, reclaim rubber or the synthetic elastomers mentioned, and other materials had to be developed. A little work had been done prior to the war on polyvinyl chloride and its copolymers. They seemed to be plentiful, and efforts were made to determine what could be done with them. A good many difficulties were encountered in processing these materials. They were tough and required particularly high temperatures in milling and calendering—much higher than the machines were built to withstand. Rubber processed at around 200° F., whereas vinyl chloride copolymers required 220 to 275 or even 300° F. A lot of machines were damaged and put out of commission for a time due to warping of calendering rolls and burning out of bearings. Although the vinyl chloride resins have been handled successfully since the experience of those early days as a result of intensive development work, nevertheless, a material was being sought that would process like rubber. This was finally found in polyvinyl butyral.

Polyvinyl butyral when compounded like rubber seemed to be the perfect answer to the rubber manufacturers' problem, but technically it had certain disadvantages in that it was too thermoplastic for practical use. Further research finally resulted in finding means of overcoming that thermoplasticity. This was accomplished by curing or cross-linking. This now is probably the outstanding resin for use on rubber-making machinery because it makes use of mills, calenders and curing equipment. It allows the personnel in the factory to use their experience in the handling of rubber in the handling of this new coating composition.

After a time, like all other materials that were used as a substitute for rubber, polyvinyl butyral became hard to obtain except for the most necessary military purposes. Technical groups started probing deeper into the resin field for suitable materials that could be adapted for coating compositions. Experiments were carried out with a good many materials such as ethyl cellulose, cellulose acetate and cellulose acetate butyrate. Many problems were encountered. The materials were either too tough or too hard to process on rubber-making machinery. If the processing was not a problem, the finished product was either stiff or lacked some other important property. If plasticized sufficiently to give pliable films, they were too tacky to process and the films did not have much strength. These types of materials probably could be used but would adapt themselves better to processing means other than calendering.

Films produced by spreading

Whereas the discussion up to this time has dealt mainly with the calendering procedure for forming films, the rubber-coated fabrics industry always has done a good deal of coating by the spread method using dough formed by mixing compound with solvent. Neoprene, Perbunan, Hycar and some of the others processed very well by this method. Products were made from these materials for special purposes wherever they were allowed to be used and where the films required were too thin to be applied by the calendering procedure. Polyvinyl butyral also was tried on spreaders and found to be fairly good in its processing characteristics. However, since it was getting scarce, the consensus of opinion was that a search should be made for a coating composition that could be applied by the spreading procedure but which need not necessarily be suitable for calendering. Work on this problem resulted in the selection of an alkyd resin modified with polyvinyl butyral or other resins to toughen it up. This composition was found to process very well and produced a good coated fabric. It has been used in considerable quantities for Chemical Warfare purposes.

Butyl and Buna S synthetic rubbers

Although development work has been going on with it for about a year, Butyl rubber has just recently come into small scale production. To date, with the amount made available for experimental purposes, it appears to have all of the characteristics that the rubber-coated fabrics industry has

2—Clothing worn by this decontamination crew is made from fabrics coated with special gas-impermeable composition.
3—Special synthetic rubber-coated fabric coverings are employed by the Signal Corps to protect radio apparatus

2

OFFICIAL PHOTO, U. S. SIGNAL CORPS

3

been looking for. Its processing characteristics are excellent—very much the same as natural rubber. Films produced from it age well, are unusually impervious to the passage of gas, are pliable, have good cold-crack resistance and, like all other vulcanized or thermoset coatings, offer no problem when subjected to the higher temperatures. Its production is just starting and is expected to increase at a rapid rate by the end of the year. Butyl rubber also offers an excellent solution to problems in connection with spread-type coatings. It is readily soluble in gasoline, an easily procurable solvent; it makes smooth cements; and it presents no problems other than those met in making similar rubber-coated materials.

Buna S now is being produced in modest quantities although it has been available for experimental work for a considerable length of time. No one is quite ready to say that Buna S at present will be a satisfactory raw material for coated fabrics. It probably will be adopted and have some outlets. However, if there is a sufficient amount of Butyl rubber, polyvinyl butyral, polyvinyl chloride and its copolymers, and possibly some alkyd resins, it will not be necessary to use Buna S which is more suited for tires and mechanical goods.

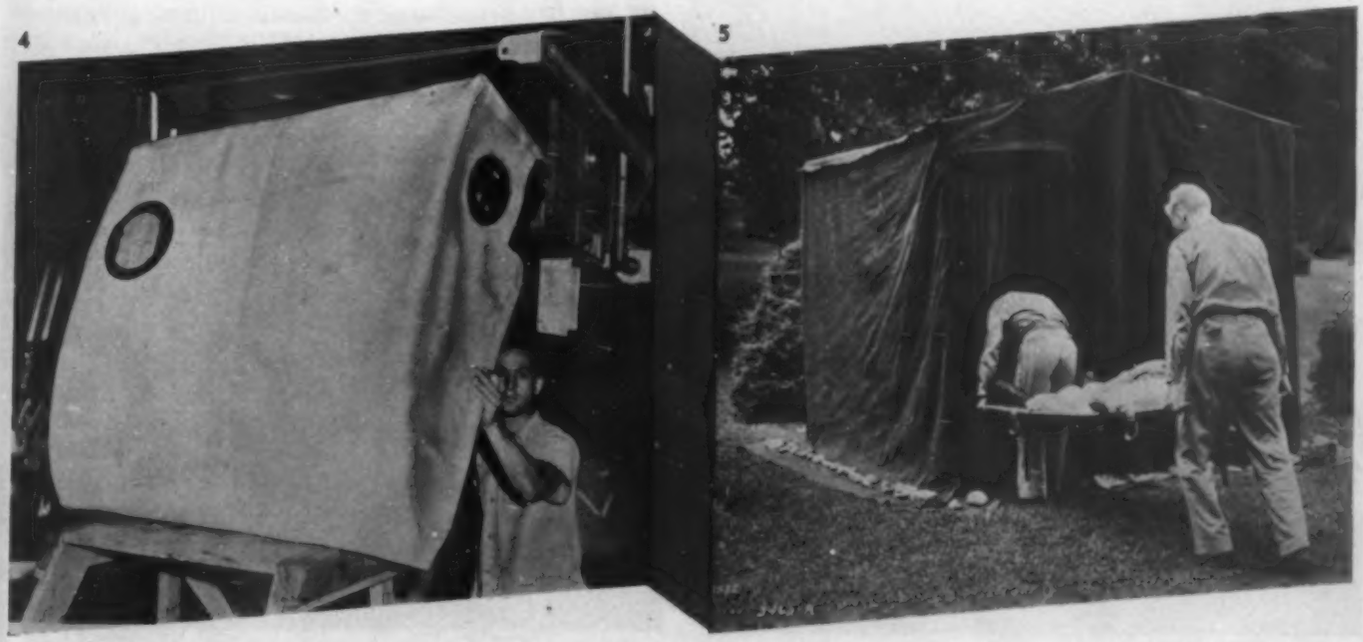
Problems with new synthetic materials

The materials mentioned thus far are those with which experience has been gained during the past year and a half. There have been many problems in connection with their use—for instance, the development of special compounding techniques to get specific properties. At times it has been very difficult to obtain properties with some of the resins that it was possible to get with rubber or synthetic rubbers. These properties include fire resistance, adhesion of the coating to the fabric, resistance to mildew of the coating (some of them will support growths of microorganisms), and water repellency of double-texture fabrics which is affected by some of the solvent systems for the resins.

Up to the present time most of the work for the war effort has been in producing coatings with a plain dusted finish. More recently, experimental work has been done in achieving special effects along the lines of those produced in the past on rubber. An example is the application of so-called lacquer-type finishes which are applied to surfaces to obtain greater scratch resistance or dullness of luster. Another problem has been the fabrication of a coated material into a finished article. Many excellent pieces of material have been produced which were found difficult to make into finished articles because the seams could not be cemented or the seams were so weak that in usage they would break apart. This condition necessitated a special study of cements, adhesives and methods of fabricating. With rubber there was no problem since rubber cement was satisfactory. With Neoprene, a Neoprene cement seemed to work very well. But with polyvinyl butyral and polyvinyl chloride coatings a satisfactory seam could not be made with the use of the respective resin composition in solvent, particularly if the polyvinyl butyral coated material was cured. The solution to this problem was the fabrication of polyvinyl butyral products from uncured material. In this way the seam areas could be solvent activated and caused to adhere to each other. Afterward the entire article was cured in an oven. As a result the seams were almost as strong as the adhesion of the coating to the fabric. In handling polyvinyl chloride or copolymer type coatings, it was found that a Hycar cement worked unusually well. Up to the present time, when fabricating articles from this type coating, this has been the preferred adhesive in making seams. However, a few sample seams could be sealed with heat and pressure alone. Just recently there has been a ruling that because Hycar is so essential for aircraft work some other means of cementing polyvinyl chloride surfaces will have to be worked out. Along this line some progress has been made in adapting polyvinyl chloride-acetate adhesives, but a good many problems were encountered requiring the modification of the coated fabric itself. These include changes in the type of fillers that were used in the compound and the type of finishes that was applied to the surface.

The constructions of fabrics coated with any of the aforementioned materials were very (*Please turn to page 164*)

***4**—Self-sealing character of this airplane fuel tank is due in part to its lining of gasoline-resistant chloroprene sheet stock without fabric insert.* ***5**—Fabric for this portable dark room tent is coated with synthetic rubber*



PLASTICS

1 Tool kits of Army Air Force mechanics no longer are complete without transparent Nitron hammers manufactured by Norwalk Upholstery Co., Yardley Industries and Plastex Trim Co. These hammers, used in shaping thin metal skins of aircraft, were adopted by the General Procurement Branch at Wright Field after extensive tests showed they would stand temperatures from 60 to 140° F., would not mar metal surfaces and would withstand long, hard use without chipping or breaking. Also manufactured by R and R Plastics, Inc., for use in war plants, the hammer has a head which is machined from a Nitron rod, then fastened with a pin of the same plastic to a handle made of hickory.

2 Taking the place of the familiar metal sink drains are these snow white Lumarith plumbing fixtures which do not rust or corrode, and require no "surfacing" to protect their finish. The plastic drain assembly is made up in 3 sections. The drain, surface lip and the long threaded section that fits in the drain pipe are in one piece. Completing the assembly is a rubber washer which is held in place by a Lumarith washer shaped to fit any standard wrench. The drain is molded by Plastics, Inc.

3 Too often safety glasses are cast aside because of the weight they throw on the nose or because of their lack of adjustment to individual features. The self-adjusting and self-locking leather nose piece, which is interlaced through parallel slots molded into the rims of these goggles, overcomes one of these difficulties. The other drawback is eliminated through the adoption of lightweight acetate as the material for the frames. So that the threading of the rims might be included in the one-piece operation, Consolidated Molded Products Corp., ejects the rims from the mold while still warm. The goggles are manufactured by Harry Buegeleisen, Inc.

4 Requirements for aerial safety equipment are severe. Parts must not corrode, and they must not be affected by long storage, atmospheric conditions or extremes of temperature. The Russell Manufacturing Co. has developed an ingenious method of "tipping" aero safety belts with Durez resins thereby saving a considerable amount of vital metal while meeting the above specifications. Belt ends are cut to desired shape, impregnated with resin, molded in a hot press and then trimmed of flash.

5 Standard equipment for the Seabees are these sharp-edged knives with handle butts molded of Resinox. When the Navy adopted plastic handle butts it laid down 2 requirements—

in REVIEW

impact strength and ability of the parts to take polish after abrasive operation. The butts are molded for Camillus Cutlery Co. by the Oris Manufacturing Co. in 6-cavity molds at a line pressure of 2000 p.s.i. The mold which is semi-automatic was designed so that 3 more cavities can be added when necessary.

6 Up and down our coastline mammoth barrage ballons stand guard over plants turning out the implements of war. Contributing to the successful operation of these lighter-than-air craft are this observation window, large thimble, 3-piece valve and anchor stop, all fabricated of Catalin cast resin by Plastic Turning Co.

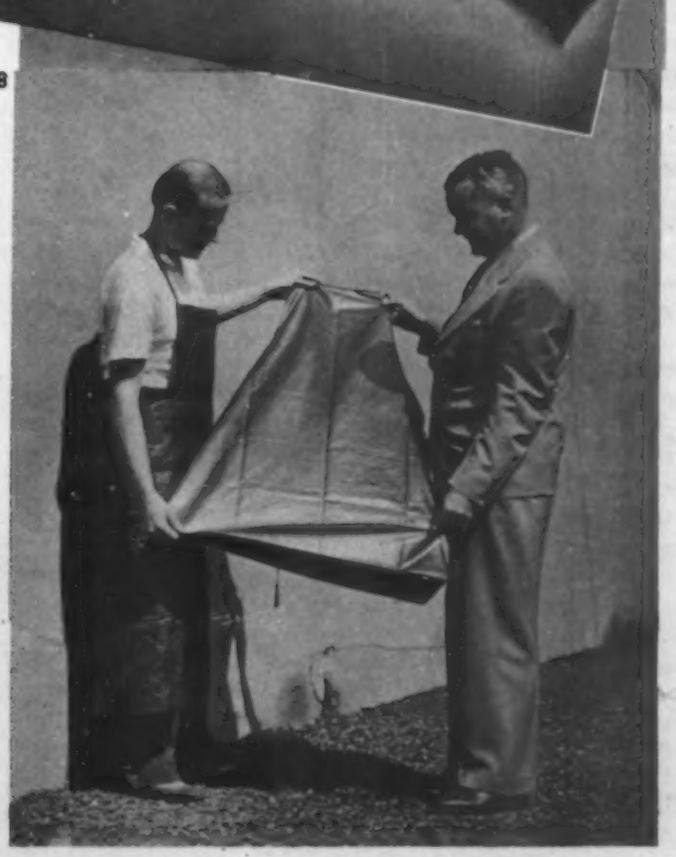
7 Emphasis is again being placed on the necessity for steady and increased war production. As one step toward the elimination of delay on the airplane assembly line due to faulty tools, the Lurite Corp. is fabricating the handles of these hammers of Plastacele for Wright Aeronautical Corp. Replacing 1-lb. aluminum handles, these plastic handles are fabricated around the steel shaft in such a manner that the two will not slip apart, and are ribbed for better gripping. As can be seen in the photo, the lead head was battered out of shape long before the handle began to show signs of wear

8 One of the little suspected dangers of the rubber shortage is a threatened spread of dermatitis among industrial workers due to a scarcity of rubber work aprons. To fight this menace, an employee of the Otto Aviation Corp., developed a plastic apron which has all the desirable qualities of a rubber covering but only one-seventh of its weight. The new apron is made of cotton lawn cloth coated with Resistite, a polyvinyl butyral resin, and then calendered. After the apron is cut to pattern and bound, tie strings are fastened with metal grommets reinforced with sewn-in inserts. Complete with double bib and turned-up cuff, the apron is manufactured by Nu-Lite Manufacturing Co.

9 Mystery of mysteries—both halves of this fairlead grommet (left), injection molded of Tenite II, are exactly alike yet so designed that male and female members lock securely together in assembly. These little grommets are used in aircraft to protect wires, cables and pipes from chafing as they pass through partitions. Knobs (right) are molded of Tenite II in different shapes, so that pilots can distinguish the various controls by "feel" as well as by sight. Both items are molded by Modern Plastics Co. for Douglas Aircraft Corp.

7

8



9

A redesigned dental surveyor

Through successive models since its introduction 25 years ago, the dental surveyor has been changed and improved to keep pace with new technical and prosthetic dentistry. The new model which is composed entirely of plastics, represents a noteworthy achievement both in its modern design and production

DENTAL supply houses always have been more than sources of raw material. It has been the practice of these companies to implement their services to dentists by advancing techniques and by offering special devices for use in applying these new methods. A case in point is the system of partial denture construction worked out by the J. M. Ney Company and the new plastics surveyor employed in the execution of this method.

Study of removable bridges that failed to function properly brought to light the fact that frequently the difficulty was due to improper clasp design. Clasps have a three-fold purpose—to provide retention, bracing and support. So that the clasps can function to the best advantage this dental supplier devised a method of first surveying a model to locate accurately the positions of undercuts on all abutment teeth and involved soft tissue, and to determine the most favorable path of insertion.

A model of the patient's mouth is cast showing remaining teeth and the gaps to be filled. This model is placed on the table of the dental surveyor which has a tilt top to permit surveying at the proposed denture's best possible angle of insertion. The table then is rotated so as to bring the teeth on the model in contact with a carbon rod held by the instrument. The carbon marks made on the teeth are like the contour lines on a topographic map and indicate the greatest circumference of each tooth at all exposed points in relation to the same points on the other teeth. With this accurate marking the bridgework can be designed to rest on the natural teeth above the line or cling to them below the line to prevent vertical movement of the new denture. Without the surveyor no accurate means of determining the exact points of greatest circumference can be obtained.

Until the outbreak of war aluminum surveyors were used for this foundation work. When metal was put on the critical list this supply house in conjunction with three other companies started production on a completely redesigned instrument (Fig. 1) assembled entirely from methacrylate parts mounted on a circular glass base together with a urea tilt-top table. As shown in Fig. 2, the unit can be completely disassembled—a distinct advantage from a shipping standpoint. The 11 plastic parts which comprise this instrument are the center column, a column base screw which holds the column to the base, a column bearing screw with acorn head, 2 pieces which make up the horizontal rotating arm, a spindle locking screw which is inserted in the rotating arm, a vertical spindle, a knurled spindle head nut, a spindle chuck nut which holds the rod or carbon marker, and the 2 sections of the surveyor table.

The center column and all other clear methacrylate parts first are produced in rod form, then machined to the desired shapes. Even to knurling of the adjustment knobs the machining is done in much the same way that metals are handled, and with equal accuracy. An ingenious feature of the surveyor body is the design (*Please turn to page 168*)

2—View of the 11 plastic parts comprising the surveyor shows how completely the unit can be disassembled

2

Society of Plastics Engineers' meeting

THE one-day convention on Friday, Oct. 8, of the Detroit Section of the Society of Plastics Engineers set a new record for attendance and displays with a registration of 2000 and what was declared to be the largest plastics exhibition ever assembled by the Society. The program which consisted of morning, afternoon and evening symposiums was conducted in the auditorium of the Horace H. Rackham Memorial Building while the exhibit of plastics materials, manufacturing equipment and products filled the entire banquet hall. Because of wartime conditions there was no banquet, but many groups formed private parties following the convention sessions, to continue their discussions. General chairman, Bart L. Batty, was assisted in the formation of the program by the following heads of committees: reservation and reception, L. J. Morrison; registration, George C. Gress; publicity, Fred Conley; exhibition, George Graves; printing, Charles R. Burgess; hospitality and friendship, Charles Hamilton.

The first of the three sessions which began at 9:30 a.m. was addressed by Dr. Franklin Strain of Columbia Chemicals Division, Pittsburgh Plate Glass Co., on the subject of "Allyl Resins." T. D. Perry of Resinous Products and Chemical Co., then spoke on "Plywood for War." The afternoon session started at 2 p.m. with an address by Dr. Marie Bentivoglio of Plastics Division, Celanese Corp. of America, and concluded with a discussion on the creation of a molded product, in which Montgomery Ferar, S. D. Hiltebrant, John Lougheed, T. D. Perry and L. J. Morrison participated. C. F. Kettering, vice-president and director of research of General Motors Corp., spoke at the evening session on "Plastics in the Motor Car Industry." Mr. Kettering was followed by Alan S. Cole of MODERN PLASTICS magazine who talked of "Plastics in the Postwar World." The MODERN PLASTICS movie, "This Plastics Age," brought the evening to a close.

SPE

In his welcoming address William B. Hoey, president of the Detroit Section of S.P.E., outlined the purpose and aims of the organization and explained the immediate program of advancement contemplated by the group. "We believe that there is a place for an engineering society of and for the technical men of the plastics industry," Mr. Hoey said. "We believe that there is need for an established and recognized forum for the discussion and study of engineering problems relating to plastics and their utilization—that there should be an unbiased source of technical information on plastics. This society, organized along the same lines as the national engineering societies, has general aims, identical with those of the older established organizations.

"In order to carry out our purpose the activities of the society are divided into 2 distinct phases. The membership first is grouped into regional or geographical sections to enable members in various localities to hold meetings at regular intervals. The second and more important phase of the society is the proposed work of the technical activity committee. A general committee of technical activities has been created by the national organization to coordinate these various discussion and study groups or, as we refer to them, the local technical activity committees. The technical activity committees already established are molding materials, molding technique, mold design, product design, laminating practice and fabricating. While every geographic section has its own subgroup for each technical activity, the efforts of all subgroups are combined and coordinated by the national committee for that particular activity. Further, the work of all the national committees is tied together by the general committee of technical activities.

"This second phase of the society is very much in the embryo stage. It was felt that the more important task was to get the local sections established and as many men as possible interested in the movement. We now have 2 sections—Chicago and Detroit—and we hope during the fall and winter to organize new sections in other cities. We trust that engineers and technical men of the plastics industry will see the possibilities of a national engineering society.

Dr. Franklin Strain of the Pittsburgh Plate Glass Co., presented the first of the scientific papers which comprised the day's program. There follows a digest of his speech on "Properties of Columbia Allyl Resins":

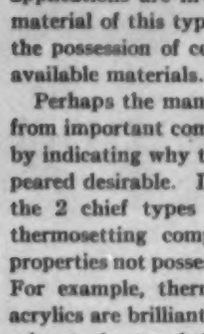
A report on the present status of Columbia series of allyl resins will be in the nature of a review unfortunately somewhat re-

WM. B. HOEY, PRESIDENT OF THE DETROIT SECTION AND GEORGE C. GRESS

GEORGE GRAVES, BART BATTY, L. J. MORRISON AND FRED CONLEY

stricted by orders of secrecy imposed upon us with regard to the chemical nature of the new materials. In addition all present applications are involved in the war effort. As with any new material of this type, its life and usefulness are dependent upon the possession of certain superior properties not found in other available materials.

Perhaps the manner in which the Columbia allyl resins differ from important commercial plastics can be clarified most readily by indicating why the development of the new materials has appeared desirable. If one considers the merits and weaknesses of the 2 chief types of commercial plastics—thermoplastic and thermosetting compounds—it is apparent that the desirable properties not possessed by one type are often found in the others. For example, thermoplastics such as the vinyls, styrene and acrylics are brilliantly clear and glass-like, but their resistance to solvents, heat and abrasion is relatively poor. The thermosetting phenolic and urea types, on the other hand, while less satisfactory as glass-like, clear materials, possess the high heat, solvent and abrasion resistance lacking in the thermoplastics. As a result it has appeared desirable to attempt to achieve a new plastic combining the advantageous properties of both of the other types.



DR. F. STRAIN

A thermosetting plastic produced by pure polymerization reactions has been conspicuously absent from the classification of commercial plastics. Such a new material might serve as the missing link combining the colorless clarity of the thermoplastics with the solvent, heat and abrasion resistance of the thermosetting compounds. These clear thermoplastics are produced by monomer polymerization in which no by products are evolved—a process in sharp contrasts with the curing of thermosetting compounds by condensation reactions which evolve water and other volatile by products. The fact that these materials of the thermosetting type have not become important in transparent form may be ascribed in part to restrictions imposed by the evolution of by products. Other serious problems have been created by these by products in the manufacture of well-known thermosetting materials, and also it might be anticipated that these would be conveniently avoided in a new thermosetting plastic curing by pure monomer polymerization. These expectations have been realized in a number of the Columbia allyl resins which are of this thermosetting type.

The Columbia allyl series consists of a family of pure, organic, monomeric chemical compounds. Each member of the series differs in chemical structure from the others, and because of these structural variations the polymers of the series cover a wide range of hardness, strength and flexibility. By suitable adjustments in structure or tailoring of the monomer molecules, particular properties demanded of the final polymers may be emphasized. In general the new thermosetting monomers are clear, colorless, water insoluble, organic liquids of low viscosity and low volatility. They are stable at ordinary temperatures and normally may be stored for long periods without change. When heated in the presence of a catalyst such as benzoyl peroxide, the monomers gradually become sirupy and gel rather suddenly. The gel when first formed possesses only low strength, but on further heating a hard, strong, insoluble, infusible, clear, colorless solid results. Since no gases or other volatile products are evolved and the polymerization process simply consists of gradual solidification of the relatively non-volatile liquid monomer, the new materials may be regarded as the true casting type resins.

At their present stage of development certain of the new materials has proved to be particularly well adapted to the production of transparent cast sheets. For example pure C.R.39, a typical member of the series, may be cast-polymerized in molds possessing smooth surfaces so as to yield clear, glass-like, flat or clear sheets.

The shrinkage which occurs during the polymerization must be accommodated by the mold. This clear cast polymer has characteristics which would be predicted on the basis of its thermoset nature. It is highly resistant to chemicals and solvents and to flow under heat. Also it is exceptionally clear and free from haze. In specific gravity, strength and shock resistance, this clear plastic is comparable with other transparent plastics.

One of the outstanding characteristics of the clear C.R.39 polymer is its remarkably high abrasion resistance. It is greatly superior to other transparent organic plastics in resistance to marring to the point of failure in glazing applications, and it also is superior in resistance to actual wear. When subjected to the action of airblow particles C.R.39 appears equal to glass in abrasion resistance. Rubbing with a windshield wiper or a polishing cloth containing grit shows it to be greatly superior to the thermoplastic glazing materials but considerably inferior to glass. The objectionable crazing tendency exhibited by the transparent thermoplastics when held under stress—particularly when exposed to solvents or vapors—never has been observed with C.R.39 even when exposed under extreme conditions. The polymer is exceptionally resistant to weathering, and although slight yellowing may occur after prolonged exposure this is not accompanied by any substantial decrease in clarity or light transmission.

To present a fair picture of the new materials as typified by C.R.39 it should be stated that the advantages attained in overcoming some of the important weaknesses of the transparent thermoplastics have been obtained at some sacrifice. Somewhat greater care is necessary in common machining operations due to a tendency toward notch sentitivity or apparent increased brittleness at room temperatures. When this characteristic is taken into account, it is possible to perform such operations as sawing, turning and drilling without difficulty. The infusible character of the polymer actually facilitates operation. As a result of heat developed by such operations as sanding, grinding and polishing, there is no tendency to drag, fuse or gum as sometimes happens with the thermoplastics. The capacity for forming or drawing the new allyl plastics into curved windows is restricted somewhat as compared with the thermoplastics because of the absence of plastic flow in the thermoset materials. While it has been assumed that the thermoset or cross-linked polymers remain substantially unaffected by heat up to temperatures at which decomposition occurs, certain of these materials pass through a transposition range analogous to the softening range of a thermoplastic. Above this temperature range they

exhibit a greatly increased elasticity and can be formed or shaped to a limited extent.

C.R.39 distorts readily above a characteristic temperature range. Above this range the maximum distortion is practically independent of temperature. If the bar is unloaded while hot the distortion will practically disappear—showing that this distortion is almost wholly elastic and consists of very little if any plastic flow. If the distorted plastic is cooled under load, however, the distortion is frozen. This behavior explains how fully cured sheets of C.R.39 may be formed while hot into simple bent shapes and into moderately compound curves. Studies of heat distortion indicate that for C.R.39 no advantage in formability is to be gained by heating above a preferred temperature range of 100 – 115° C. The cooled curved material tends to retract to a small extent, but this can be prevented by retaining in a very light frame. The degree of formability of C.R.39 thus is restricted by the thermoelastic limit of the material. Deep draws are not possible though simple curved and compound windows and other shapes of limited radii of curvature readily are obtainable.

Because of its freedom from plastic flow, C.R.39 is not marred easily during forming, and the tendency during the hot shaping for development of surface spots and waves producing optical distortion is much less than with the thermoplastics. The forming process may be considered as an alternate to the direct casting of curved sheets. The direct casting method is somewhat more complicated but yields curves of exceptional form stability. Other properties of C.R.39 worthy of mention are its burning rate which is approximately that of the cast acrylic resins and its high photoelastic sensitivity with distinct fringe and small optical creep. The cast material also exhibits the property of edge lighting.

For the development of optimum properties the older thermosetting plastics have required relatively high pressures in curing. Strong and expensive molding equipment has been necessary for applying these pressures at a relatively high cost in manpower. On the other hand the new thermosetting materials require almost negligible pressures because no gases are evolved during their polymerization and because they may be applied directly as low viscosity liquids which do not require pressure for penetration. Solvents are unnecessary. The monomeric or partially polymerized viscous resin is cast within the porous structures, and the only pressure required is that desirable to keep the fibrous base satisfactorily compacted. In lamination, for example, only enough pressure is needed to keep the plies in contact with each other. Since only very low pressures are required, weaker molds from cheaper, more readily available materials such as wood, plaster, papier-mache, concrete and sheet metal may be used.

The thermosetting monomers of the allyl type, C.R.39, for example, possess a number of additional properties rendering them well suited to use in simplified procedures in the fabrication of laminates and similar structures. C.R.39 is exceptionally stable in storage at ordinary temperatures. No polymerization inhibitors are required for stabilization. Due to the low viscosity and good solvent power of the monomer catalysts are incorporated readily and without the use of added solvents. The resulting solution may be kept for convenient periods at room temperature before an increase in viscosity due to polymerization becomes noticeable. The low volatility is particularly favorable since this quality minimizes the irritating effects often encountered by workers in the handling of volatile resinous materials, and avoids losses by evaporation and changes in composition during storage. The volatility is sufficiently low to permit utilization of vacuum techniques relying entirely upon the atmosphere for application of pressure. A high degree of penetration of fibrous or porous base materials is favored by the low viscosity of the momomeric material, and simple techniques may be used in impregnating base materials.

It should be mentioned that polymerization of monomers such as C.R.39 is inhibited by such agents as lead, copper and such sulfur compounds as are present in vulcanized rubber and atmospheric oxygen. Although polymerization must normally be conducted in the absence of these agents, special modifications of the Columbia materials have been developed recently which may be cured in the presence of air. It must be emphasized that the new type of thermosetting plastic still is relatively a newcomer to the family of plastics. However it seems entirely safe to predict that as development continues it will take its place as an important member of the plastics family.

Second speaker on the day's program was Thomas D. Perry of Resinous Products and Chemical Co., who spoke on Plywood for War. His address which is condensed here, included a brief résumé of early plywood utilization and the limitations which confronted manufacturers 25 years ago, and a discussion of the improved materials and techniques now available.

In order to achieve a proper perspective for the intelligent evaluation the excellent present-day plywood adhesives, it is important to review briefly the adhesives that were available at the time of World War I. At that period casein—made from the curds of soured milk—and albumin—a dried blood product coagulated under heat—were considered the most durable adhesives for aircraft construction. However neither would withstand an elementary fungi and mold test. In fact, under suitable conditions, both encouraged such parasitic growths. Casein was abrasive on edge tools and its resistance to continuous soaking and to alternate wet and dry tests was relatively low. Furthermore it failed quickly in boiling water. Albumin plywood could be soaked for many days, would resist several cycles of wet and dry tests, was not abrasive on tools but was found to deteriorate seriously with age.

T. D. PERRY

In spite of these limitations plywood continued to be used extensively in aircraft for some years after the war. Gradually it was displaced by metal. Soon after 1930, resin adhesives began to attract the attention of the plywood industry. At first only phenol formaldehyde resin was available, and in film form it was on an import basis—the high import cost retarding growth of the resin adhesive program.

By 1935 the demand for phenolic resin film was sufficiently urgent to justify domestic manufacture. Spurred on by the reduction in price and the excellent durability characteristics of the resins in bonded plywood, the aircraft industry began to renew its interest. The improved durability factors were: complete waterproofness, high resistance to bacterial growth, and boilproofness which facilitated bonding and curving after steaming. The liquid phenolics which were developed several years after the films, also were found to possess similar durability characteristics. Thus the principal objection to the use of plywood in aircraft was removed.

The technique of bonding with film is simpler than the mixing and spreading of a liquid although both methods are practiced. The interleaving of the dimensioned film between veneers of 8 to 12 percent moisture content is the only preparatory step required. Whether film or a phenolic solution is used, the assembled sheets of veneer and adhesives are subjected to simultaneous heat and pressure for an interval varying from 5 min. for $^1/_{16}$ in. to 12 min. for $^5/_{16}$ in. plywood at 300° F. under a pressure varying according to the density of wood from 125 p.s.i. on spruce to 250 p.s.i. on birch. Resin technique requires more care and precision than was considered necessary with the older glues. While this procedure ordinarily applies to flat plywood sections, it is equally practicable to preform a wide variety of plywood shapes in heated metal dies, limited to such a range of shapes as will not rupture the veneer Flat plywood within reasonable limits, can be steamed thoroughly, formed and dried in wood or metal dies. The use of heat is optional and dependent upon the speed required.

The processes so far described apply to what is termed normal plywood where the density of the wood may be increased somewhat by the addition of the resin and the slight compression of the veneers—approximately 5 to 10 percent—which is required

to bring the surfaces into contact for positive bonding. Further compression with higher specific pressures during the bonding operation, imparts an entirely new range of strength properties. It was discovered that poplar when compressed under the same pressure, showed substantially the same specific gravity and had approximately the same strength factors as birch. However 105 sheets of 1/48-in. poplar were required to produce a 1-in. thick sample at 1500 lbs. pressure as contrasted with 85 sheets of 1/48-in. birch.

High density plywood also can be made by impregnating the veneers with a liquid phenolic resin, pre-drying and then hot-pressing as in the case of film. While this process is more complicated, it will give more complete impregnation. In general, the use of film results in wood reinforced with resin with wood characteristics predominating while the use of liquid resin produces a plastic reinforced with wood more closely approaching the physical characteristics of plastics.

Though the phenolic resins with the quality characteristics that have been outlined, have not yet found general favor in assembly work, as a primary adhesive for plywood, another group of resins —the urea formaldehyde type—is well adapted to secondary or assembly work. With a proper catalyst the mixtures are stable and "live" for 4 hr. after mixing and will cure at minimum room temperatures of 70° F. However the quality of the bond is improved by the application of heat up to 140° F. while under pressure for a 4 to 8 hr. period. In this process the curing also is accelerated. This type of urea resin comes in a liquid form which is reasonably stable for storage before the catalyst is added, as well as in powder form with the catalyst added.

A similar type of urea resin also is available for hot pressing where temperatures of 230 to 260° F. and specific pressures of 100 p.s.i. and up both can be obtained simultaneously as in standard flat plywood. This type of urea resin can be mixed with substantial amounts of low-cost extenders with some sacrifice in durability. Its dry strength is excellent, and under severe exposure it is better than casein. The cost is very moderate, and it has found wide use in such products as furniture and radio cabinets. Its use in aircraft plywood is discouraged since phenolics give a more durable bond at slightly higher temperatures.

There has been much publicity on the subject of plastic planes —a somewhat inaccurate description since the planes so far have been molded plywood with resin adhesives and finishes. The principles involved in molding plywood are old, and the only novel features were the methods of applying the pressure. The fundamental principle is that of using an inflated or deflated rubber bag as one of the halves of a pair of molding dies. Not only is there the saving in matching up a pair of dies where the intermediate distance between halves must be accurately determined, but in many cases the dies are wholly eliminated.

Another type of flexible pressure that is growing in importance is that of tubular pressure where a deflated hose or tube is clamped or held against the surface on which pressure is to be exerted. Inflating the tube with hot or cold water, steam or air affords measurable and uniform pressure and heat. Such tubes which can be used singly or in multiple, provide a simple and inexpensive method for pressure application in many wood constructions.

The conventional method of applying heat for the cure of resin adhesive bonds has been that of steam usually circulated in flat or slightly formed platens of a hot press. Since the heat penetrates the plywood assembly from the upper and lower surfaces, the exterior is considerably hotter than the interior. Since heat is used wholly to cure or convert the resin, it is apparent that this method is particularly adaptable only to relatively thin plywood. A more recent method of heating wood assemblies is with radio frequency power—often called high frequency. With this equipment the wood or veneer assemblies are placed between insulated electrodes and terminals of a high frequency generator.

Still a third method of applying heat in the cure of resin adhesives is that of electric resistance plates with heating units installed therein similar to those in electric flatirons. This heat can be obtained from ordinary electric current sources. One method of applying this process to flat plywood is through the use of electric resistance plates instead of the usual aluminum cauls. Resistance plates also can be used in many types of presses and clamps where the distance of the required heat penetration is not so great as to mar the wood.

SPE

Dr. Marie Bentivoglio of Celanese Corp., Plastics Division, opened the afternoon program with a paper on "The Place of High Acetyl Cellulose Acetate in the Cellulosic Family." The lecture was well illustrated with diagrammatic and pictorial slides. It was Dr. Bentivoglio's first appearance before the Detroit section, and Mr. K. W. Kithil, Detroit representative of the Celanese Celluloid Corp. introduced the speaker. "Dr. Bentivoglio who comes to us from the land of the antipodes," said Mr. Kithil, "is a science graduate of the University of Sydney, Australia; she did post-graduate work in Oxford, England, where she took the doctor's degree in chemical crystallography and the diploma in geography. She returned to Australia, and during vacations from her duties as acting-professor and lecturer in the University of Sydney, she found the time to go on trips of exploration into the little known interior of that continent. At present Dr. Bentivoglio is attached to the Development and Research Division of the Celanese Corp., Plastics Division."

DR. BENTIVOGLIO

Dr. Bentivoglio in acknowledging the introduction, picturesquely compared the primitive world of the interior of the Australian with the modern world in which plastics play such an important role. The following is a digest of her address.

Plastics have come into their own and established themselves as an important source of raw materials for the manufacture of a wide range of articles from decorations for feminine embellishment and household utensils to essential parts for aeroplanes and other paraphernalia needed in a global war. Plastics graduated a long time ago from the experimental stage to take their rightful place along with other essential raw materials required in manufacture, but they have been catapulted into their present prominent position by the exigencies of today's war economy.

Plastics may be expected to invade some of the fields held by metals, wood and glass and to be directed in many channels of ornament and utility to delight the eye and add pleasure to the art of living in a postwar world. But we also may look to an expansion and development in design, decoration and architecture streamlined to meet the many plastic materials available.

One of the chief reasons for the enormous variety of plastics which may be expected after the war, is that potential sources of raw materials abound as by-products of farm, forest and petroleum fields. Cellulose was the first raw material to be used in the manufacture of plastics. While cellulose is found in the walls and skeletons of cells of all vegetation, it is particularly abundant in cotton, and it forms more than 90 percent of the loosely matted cotton linters which remain after the cotton is ginned.

The differences between the members of the cellulosic family of plastics rest basically on modifications made in the chemical structure of cellulose. The structure of the molecule may be considered (for the present non-technical but descriptive purposes) as a series of residual glucose ring units joined by glucoside linkages in such a manner as to form long chains of indefinite length. These molecules, each consisting of a long chain, are loosely interlaced one with the other, and both their length and interlacing arrangement impart to cellulose, good mechanical strength, toughness and stability.

Each glucose (or ring) unit in a cellulose molecule contains 3 hydroxyl or OH groups; and it is on these that attention must be focussed for the present discussion. These OH groups may be

considered as the variable (or unstable) parts of the molecule, readily subject to chemical action. Thus, if cellulose is acetylated (or subjected to the chemical action of acetic acid, acetic anhydride and a catalyst), the hydroxyl groups are replaced by acetyl groups—that is, each glucose unit of the molecule has 3 acetyl groups substituting the original 3 OH groups—and the resulting product is triacetate.

To make the cellulose plastics of commerce, this primary acetate must be hydrolyzed, or "ripened," in the presence of water. As a result of this reaction some of the acetyl groups are again replaced by OH groups. If the ripening is stopped short so that only a few OH groups are substituted for acetyl groups, then the percentage of acetyl content (as acetic acid) is relatively high and the high acetyl cellulose acetate of commerce results. Carry the substitution further, so that an OH group replaces approximately each third acetyl group, and the normal (or so-called low) acetyl cellulose acetate of commerce results. The number of OH groups present has a far-reaching effect on the physical properties of the molding powders ultimately prepared from these flakes. For example, molding powders prepared with high acetyl cellulose acetate have a lower water absorption and a greater dimensional stability than those prepared with normal cellulose acetate flakes. The differences in the chemical structure of the high and normal acetyl cellulose acetates were graphically shown in slides.

If the original cellulose is treated with alkalies and ethyl chloride (instead of acids), another cellulosic base flake is formed, namely, ethyl cellulose. The best flake for the preparation of molding powders is obtained when about $2^1/_2$ of the 3 OH groups in each glucose unit are substituted by ethoxyl groups. In review, the cellulosic family of molding plastics used commercially today is prepared from the following four flakes: high acetyl cellulose acetate having an acetyl content (as acetic acid) of 56 to 58 percent; normal acetyl cellulose acetate having an acetyl content (as acetic acid) of 52.5 to 54 percent; cellulose acetate butyrate having a butyryl content (as butyric acid) of 36–37 percent and acetyl content (as acetic acid) of 14–13 percent; ethyl cellulose having an ethoxyl content of 45 to 48.5 percent.

These flakes then need a plasticizer to convert them into molding powders or the coating of fabrics, or films and lacquers. The plasticizers which may be added sucessfully to a given flake are limited in number by reason either of compatibility with the flake or of the characteristics imparted to the plastic. The molding powders prepared from the 4 basic cellulosic flakes remain to be evaluated and compared with regard to their properties and qualities. For this purpose we turn to the testing procedures established by the A.S.T.M. The purpose is to eliminate as many variables as possible (in running the tests and in preparing the test specimens), thus arriving at comparable results. As an example, the testing method for impact strength may be taken, and the control of the many possible variables (as molding, conditioning, etc.) considered. Graphs showing impact strength over a wide range of temperatures for molding powders prepared from various flakes were analyzed.

A review of water absorption showed that normal acetyl cellulose acetate, high acetyl cellulose acetate, cellulose acetate butyrate and ethyl cellulose have water absorption values improving in that order, the range extending from 2.8 to 1.3 percent. There has been a tendency to place rather too much emphasis on the precise figure showing water absorption when actually it is difficult to interpret a difference of, say, 0.5 or 0.8 percent.

A third property, dimensional stability is more difficult to evaluate because the material, the design of the die and the method of making are all variables. Consequently the dimensional stability of each manufactured piece must be considered on its own. In each instance it is the finished article that must be tested for warpage and shrinkage as the visible elements which result from a breakdown in dimensional stability. Warpage is a complex phenomenon which is partly physical and partly chemical. It results from the release of stresses which are created in molding. When molding, the temperature is high and stresses are developed under plastic flow. Then, as the material is quickly cooled, these stresses are imprisoned, so to speak, in the molded part. If we do not submit the molded piece to any abnormal strain or stress, then the stresses remain dormant, and it retains its perfect shape indefinitely. But, these latent forces may be released in a variety of ways.

Water absorption also affects warpage—but the relation is not an easy one for it has been shown that hard formulations (which always have a greater water absorption than their respective softer flows) also show the least tendency to warp. Again, though water absorption of ethyl cellulose is slightly lower than that of cellulose acetate butyrate, the dimensional stability of the former is much greater than that of the latter.

A number of slides were shown of flares (consisting of a thin walled cylinder and heavy base) molded of formulations prepared from the 4 cellulosic flakes and subjected to a number of heat and humidity tests. Significant facts revealed by these severe heat and humidity tests applied to the flares are: that soft formulations warp first; that hard formulations of high acetyl cellulose acetate flake are more resistant to warpage than those of normal acetyl; that an high acetyl formulation (H_3), a cellulose acetate butyrate formulation (H_2), and an ethyl cellulose formulation (MS), completely retain their dimensional stability when subjected to the same hot water test; that the only cellulosic plastic resisting the most critical tests was ethyl cellulose.

One of the most unusual and interesting features of the convention program was a round table discussion at which speakers representing the industries or the techniques involved, discussed problems in connection with the creation of an entirely new molded product—in this case a plastic refrigerator of new and unusual design. Participating in the discussion under the chairmanship of William B. Hoey were: S. D. Hiltebrant, Bakelite Corp., John Lougheed, American Insulator Co., L. J. Morrison, Detroit Molding Corp., T. D. Perry, Resinous Products and Chemicals Co., and Montgomery Ferar, Sundberg and Ferar, designers. The projected refrigerator was designed to take full advantage of curved surfaces both interior and exterior while presenting some unusual problems in arrangement and construction.

Speaking as a refrigerator manufacturer alert to the possibilities of plastics in manufacturing, Mr. Ferar outlined the project, explained the all-over design and described certain limitations imposed by the over-all design of the box. "There are certain apparent advantages in an all-plastic refrigerator," Mr. Ferar said. "A low-pressure molding job should be from $^1/_3$ to $^1/_2$ lighter than the present metal construction—an important factor in the refrigerator industry from the point of view of shipping. This job should be much easier to assemble since there are few component parts as compared with the great number of assemblies in the present-day metal refrigerators.

"What we would like to know is this: can this job be molded in one piece or two. We would like to know what materials we can use, and the advantages and disadvantages of each as far as water-absorption, porosity, insulation, stiffness and finish are concerned. It should be noted that in the conventional mass production method with the over-drying process, the plastic housing would be subjected to a heat of 300° for 35 to 45 minutes. Whatever plastic material was chosen would have to be selected with that factor in mind. We would like to know how we could hermetically seal this housing against moisture and what thickness in walls would be necessary. (*Please turn to next page*)

LEFT TO RIGHT: WM. HOEY, S. D. HILTEBRANT, J. LOUGHEED, L. J. MORRISON, T. D. PERRY AND M. FERAR

Mr. Perry, the first to discuss the problems outlined in Mr. Ferar's design, indicated a preference for a 2-piece shell construction if plywood were used, as the more practical and economical method.

At this point chairman Hoey suggested that other materials than plywood might be considered for the housing. Mr. Hiltebrant suggested that a paper base would give more rigidity in the molded parts of the box, and added that if the rigidity were not sufficient it could be strengthened by corrugation. Mr Perry admitted that creation of corrugations in plywood would be difficult and doubted the necessity of indentations.

WM. PHILLIPS

Mr. Morrison then turned the discussion to the problem of tools required for construction of the refrigerator housing, whether it was manufactured from plywood or from the low-pressure laminates. As a temporary solution Mr. Perry suggested the use of a wood mold with a rubber bag to force the plywood or the laminated paper against the mold faces. The wood mold might not be durable enough for ultimate production, he pointed out, but a wood mold would permit changes in design.

In response to a question from Mr. Lougheed concerning the length of time required for curing, Mr. Perry suggested that a half-hour to an hour's time would be required—depending upon the heat-absorption characteristics of the materials used. In the ensuing discussion as to the relative merits of plywood and low-pressure laminates with regard to finishing, moisture absorption and odor transmission, Mr. Lougheed suggested a combination box—plywood on one side and paper on the other.

Having agreed on the type of construction for the box, the discussion turned to the problems involved in the ice cube compartment and the frozen food divisions for which a transparent material had been suggested. From the array of plastic materials available for use, 2 of them—polystyrene and ethyl cellulose—were suggested as the best solution to the problem though it was agreed that the scratch-hardness of both was low. A similar problem arose in respect to the vegetable container door although the temperature differential was not as great.

SPE

After the evening session was opened by Bart Batty, general chairman of the convention program, William Phillips, president of S.P.E., introduced C. F. Kettering, principal speaker of the evening. A digest of Mr. Kettering's talk follows:

I think that you gentlemen have a problem that is a little different from the usual engineering problem because when you were approaching the 25-year mark— the period said to be required to get an industry going—you had a war dropped on top of you. In addition, you and your industry have had to produce 6 or 7 hundred thousand tons of synthetic rubber a year. The great impulse of the war is going to affect your industry for better or for worse depending upon how the problem is handled.

C. F. KETTERING

It seems to me that in addition to your technological problems, you have the important problem of trying to find out how you are going to get out of the meshes of war responsibility. While the automotive industry has converted to the production of other things, after the war it will return to the production of regular equipment. Not only have you been required to make enormous quantities of the materials you formerly made, but you have had superimposed upon you synthetic and related products.

The thing that worries me is that every time I try to design something from plastics I get all mixed up as to the meaning of thermosetting and thermoplastics. Their meaning seems to depend upon the person to whom you talk. The word "plastics" has degenerated into a word just like metals. When people say "metals" you don't know whether it is copper or steel or whatnot. Haven't you some table that will show what you think a material will do when it gets soft at a certain temperature, what its tensile strength is, what the mold expansion, this factor is important.

The automobile industry has been through experiences similar to those experienced by the plastics industry. Take lubricating oils for instance. As you know, we have different kinds of crude oils. Finally the number of specific oils got to be so great that we had to get the oil industry together and find out what the oils would do. Then we gave the oils names like SAE 20, 30, 40, etc. I say you ought to get some SAE plastics.

We have a lot of people who think that it is going to be a new and wonderful world after the war, but there is one thing I can guarantee. The world will remain the same for that is human nature. If a postwar plan pre-supposes that it is going to change human nature, then it is merely postwar wishing. An industry has to have a rather long period of incubation. I think anybody would be wrong if he thought that what we know about plastics is anything more than the first grade. I believe that after the war is over we can go back to a great many of these materials and the accomplishments can be anything that you can imagine.

Concluding speaker on the day's program was Alan S. Cole of MODERN PLASTICS magazine who spoke on "Plastics in the Post-War World." "In reality we haven't any idea what the postwar world is going to be like," Mr. Cole said. "We do not know what social forces we are going to deal with, what we are going to have left to work with or what imponderables are going to be part of that era. In my opinion we have a lot of thought to devote to the known tangibles of the present day world without wasting too much energy trying to make decisions that are far beyond our control. There is so much that we can do right now. The plastics industry needs our guidance and support. All of us who make up the industry have a common responsibility—for as the industry emerges from the war, so will each and every one of us benefit by its standing.

A. S. COLE

"Many of you know that the plastics industry has not always come through every assignment with flying colors. We have much to be proud of but nothing to be complacent about. Least of all can we be complacent about the picture that is being painted of our business, first to the industries we serve and then to Mr. and Mrs. America whose approval and endorsement we must earn. I warn against the form which that picture is taking and the impression that in plastics we have materials that after the war are going to fulfill every possible or imaginable use.

"Last year by actual count plastics were discovered 3670 times by individuals who came to our offices. Plastics are not new. Chemically they have been known for 110 years. Industrially they have been used for 65 years. They have had an increasing effect and impact in our industrial development for the past 35 years. They have had the normal growth of materials that have been soundly researched, carefully developed and amply tested before the manufacturing industry would adopt them. We want to see that same careful and sane development from now on.

"Of course we have a great future. I could tell you of the post-war market that is going to call for 2,600,000 automobiles, 1,800,000 refrigerators, 700,000 dining room sets, 1,000,000 vacuum cleaners, 1,300,000 washing machines—all immediately after the war. But I would rather leave you with just one thought. As far as the impression we give, let's change our mode of thinking. Let's keep it logical, careful and sane. Let's say that the plastic materials we are developing will be wisely used after the war but used only where they are structually correct and economically sound."

Plastics Engineering

F. B. Stanley, Engineering Editor

Importance of ethyl cellulose

by MILLARD DEMAREST,* W. P. MOELLER† and B. E. CASH†

ONE of the larger manufacturers of builders' hardware often describes celluloid as "the toughest non-metallic material known to man" when speaking of its use in soft hammer faces, screwdrivers and chisel handles. Up to a very short time ago this title was never seriously threatened. Now, however, a new contender is in the field and has challenged the old champion. The new contender is ethyl cellulose, and it is bringing new honors not only to its own cellulosic plastic family but to the whole field itself. Its characteristics have brought about the conversion to plastics of a major article of military equipment—the right-angle flashlight—and have caused the demand to exceed the supply. Consequently, actual experience is limited to major military applications, some of which are of a confidential nature, and to laboratory analysis.

Ethyl cellulose differs chemically from the other cellulosics which are cellulose esters in that it is a cellulose ether formed by treating cellulose with ethyl chloride and caustic alkali. Actual comparisons resulting from laboratory tests are described in detail in the second section of this article. However, a quick summary discloses that unlike celluloid, ethyl cellulose plastics are slow burning and can be dry extruded and injection molded as well as compression and transfer molded. Their toughness approximates and in some formulas exceeds that of celluloid at extremely low temperatures. Ethyl cellulose plastics can be so formulated as to have better dry and wet heat resistance than celluloid. In contrast to the widely used cellulosic compounds—cellulose acetate and cellulose acetate butyrate—ethyl cellulose plastics can, in any one of dozens of formulas, produce parts which are satisfactory for use when tested from one extreme of temperature and humidity to its opposite. Ethyl cellulose plastics are substantially lighter in weight than the other cellulosics but have not yet attained the wide color range of the older compounds. They have the advantage over other cellulosic plastics in lower power factor, improved acid and alkali resistance, along with wider solubility in solvents. Ethyl cellulose also is readily molded around metal inserts and, because of its strength, does not have the tendency to break away from the metal at low temperatures. An idea of how ethyl cellulose plastics meet the exacting specifications of the Armed Services of the United States may be gleaned from the following case histories.

* Head of Technical Service Div., Celanese Celluloid Corp. (author of Part I).
† Chemical engineers, Development and Research Laboratories, Plastics Div., Celanese Corporation of America (authors of Part II.—Analysis of tests).

Army flashlight

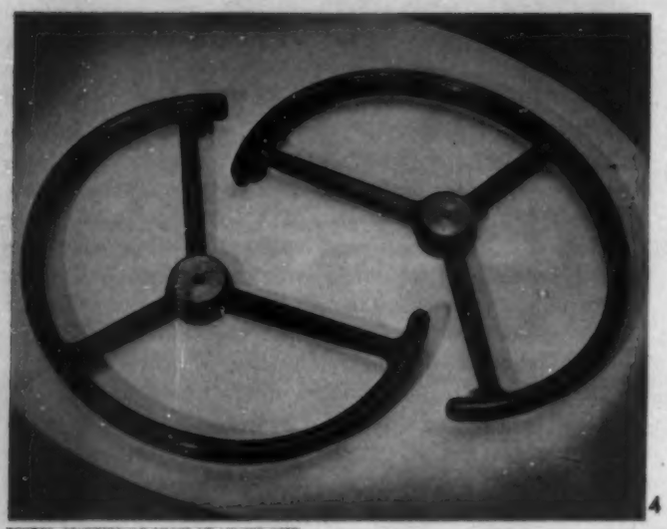
The Signal Corps TL-122-B flashlight was injection molded of ethyl cellulose before the Allocations Board ruled it out

1

2 PHOTO COURTESY CELANESE CELLULOID CORP.

1—Exacting boiling, freezing and air pressure tests were among those which had to be passed by this ethyl cellulose Army canteen before its acceptance. 2—Until the supply of ethyl cellulose became critical, it was used in the molding of this angle flashlight

3



4

PHOTOS, COURTESY CELANESE CELLULOID CORP.

3—Venturi tubes must be able to take it under extremes of exposure. These tubes are molded in 2 parts, and the halves cemented together. 4—Initial tests have shown these steering wheels capable of withstanding temperatures ranging from —70 to 180°F. and showing but slight chipping when subjected to 450 ft.-lb. impact using a 150-lb. sandbag dropped from a 3-ft. height

due to critical supply (Fig. 2). The Specification No. 17-197 is a performance specification which could not be met through the use of cellulose acetate or cellulose acetate butyrate. After thorough tests by Dr. Merrill and his associates in the Squier Laboratory at Fort Monmouth, Specification No. 17-197 was prepared. In part this specification requires the injection molded flashlight to be "subjected to a temperature of −40° F. for 2 hr. and tested at this temperature." The test which follows shall be made without the batteries installed: "The case shall be subjected to one 12 in.-lb. impact by means of a steel ball. After this impact there shall be no flaws, cracks or other defects." This is followed, still at −40° F., by a 20 in.-lb. impact on the same case as tested at 12 in.-lb., and the flashlight must still be operable.

The heat test with the batteries installed consists of suspending the samples by means of the belt hanger and subjecting the samples "to a temperature of 175° F. dry heat for 24 hr. and then to a temperature of 130° F. at 95 percent humidity for 24 hours." The tested samples are compared with control samples for dimensional stability, crazing and other defects. The flashlight, with new batteries installed, shall be "in full working order, all threads workable and all parts interchangeable with untested samples."

When information was received that ethyl cellulose was no longer to be allocated for the TL-122-B flashlight, revisions of Specification No. 17-197 had to be considered in order to permit the use of cellulose acetate and cellulose acetate butyrate. The suggested revisions are as follows: The temperature for the cold impact test, formerly −40° F., should be −10° F. The conditions for the heat and humidity test, formerly 175° F. dry heat for 24 hr. followed by 130° F. at 95 percent relative humidity for 24 hr., shall be modified to 175° F. dry heat for 24 hr. followed by 100° F. and 95 percent relative humidity for 24 hours. Note the change of 30° F. in low temperature and change of 30° F. under wet heat.

Army canteen

Another use proved by the Armed Services is the ethyl cellulose canteen shown in Fig. 1, developed in cooperation with the Quartermaster Corps. To date, no other plastic will meet the severe requirements of this specification which is identified as Quartermaster Corps Tentative Specification J.Q.D. No. 194-A. Injection molded in two halves—top and bottom—and cemented together, the ethyl cellulose canteen shall withstand 25 p.s.i. air pressure without leaking. This test is made 24 hr. after cementing operation. An impact test at +77° F. or −20° F. calls for the canteens to be completely filled with water, capped and dropped from a height of 10 ft. to a concrete surface, taking care not to drop the canteen on the phenolic cap. No fractures shall occur in this test.

The freezing test calls for the canteen to be filled with water to 90 percent of its total capacity, capped and subjected to a temperature of −10° F. for 24 hours. No fractures or failures at the cemented shoulder are permitted. Using the frozen canteen prepared as described in the paragraph above, the sample is dropped immediately after removal from the low temperature from a height of 6 ft. to a concrete surface—still no fractures permitted. The ethyl cellulose canteens without the cap and filled with water at 180° F. are placed for 1 hr. in water maintained at 180° F. After this test the samples are examined for warpage, distortion and softening. This test is mild compared with the boiling water test which calls for a canteen, not capped, to be filled with boiling water and allowed to stand for 5 minutes. At the end of this time it shall be placed in the canteen cup and allowed to stand for one-half hour. Then it is inspected for warpage, distortion and softening.

Venturi tube

The A.A.F. are extremely interested according to all reports, in the development of a Venturi tube injection molded of ethyl cellulose. The tubes shown in Fig. 3 are molded in two parts, one part over a metal insert, and the halves cemented together. It is said that the ethyl cellulose plastic Venturi tube surpasses its metal predecessor in fidelity and uniformity of performance. Low temperature impact strength, heat and humidity resistance, and ability to take it under outdoor exposure are obvious requirements for Venturi tubes. Such tubes are mounted on the outside of planes and are used with air-operated instruments.

Steering wheels

Injection molded steering wheels (Fig. 4) currently are under investigation. Up to the time this article was written some preliminary test results can be described as very en-

couraging. Molded over metal spiders, ethyl cellulose steering wheels have successfully withstood exposure to −70° F. and also to 180° F. When subjected to 450 ft.-lb. impact using a 150-lb. sandbag dropped in an arc from a height of 3 ft., there was very little chipping of the material from the metal insert.

Part II—Analysis of tests

In order to illustrate the excellent dimensional stability of ethyl cellulose in comparison with other common cellulosic plastics, our laboratory has prepared and molded under optimum conditions three cellulose acetates; three cellulose acetate butyrates—two compounded in the laboratory and one obtained from an outside source—and five ethyl cellulose compositions. These were injection molded into a cartridge-type flare case having an outside diameter of $1^1/_2$ in., a height of about $3^1/_2$ in. and a wall thickness of .053 inch. The materials shown in Fig. 5 then were given accelerated tests under various conditions in order to ascertain the type of formulation that would hold up best under these different exposures.

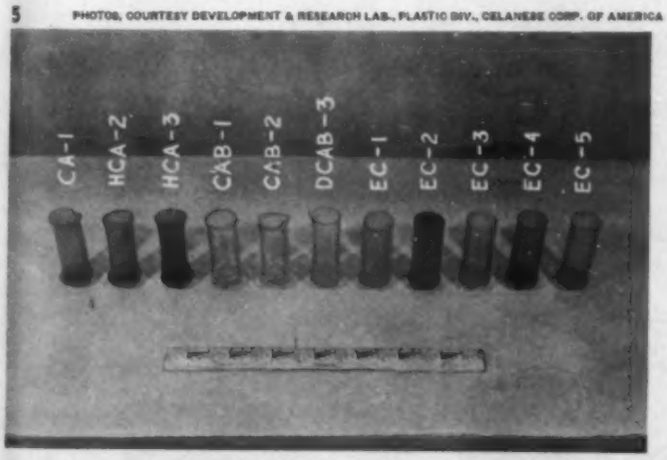
The first test consisted of immersing the samples for 30 min. in water maintained at 180° F. This test, as shown in Fig. 6, indicates that properly selected cellulose acetate or cellulose acetate butyrate composition will withstand a moderate hot water exposure although ethyl cellulose formulations provide a wider margin of safety. Figure 7 demonstrates the relative stabilities of four ethyl cellulose compositions as compared with one cellulose acetate and two cellulose acetate butyrate formulas after 3 hr. immersion in water at 180° F. Measurements and observations show the EC-4 as the superior ethyl cellulose material. No comparison could be made on the cellulose acetate or cellulose acetate butyrate as these parts were too distorted to measure. Thus all the ethyl cellulose materials tested were superior to the cellulose ester type formulations.

In the electrical field it is often important for a part to stand up under high temperatures and relatively low humidities. On this basis a test was conducted at 210° F. for 48 hr., results of which are shown in Fig. 8. Measurements and observations of the parts indicate that there is little or no difference among the three cellulosic plastics when subjected to this type exposure.

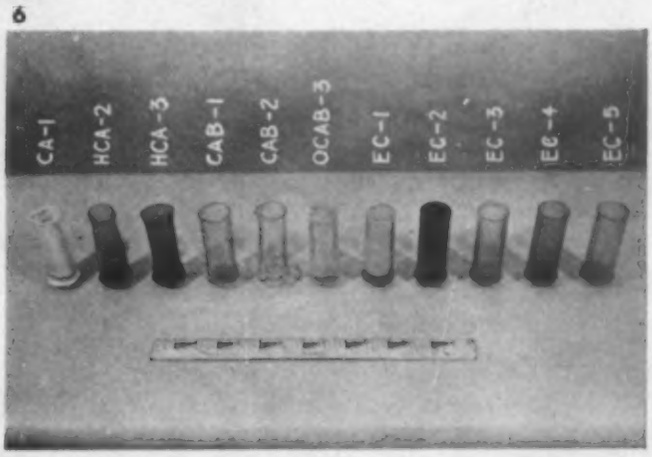
The requirements of a global war have necessitated the procurement of materials which will withstand higher temperatures and humidities than had previously been needed in a peacetime economy. For this reason the Armed Forces formulated the following cycle exposure for plastics in an attempt to approximate these conditions. The specification requires that the molding be exposed for 24 hr. at 175° F., 0 percent R. H.; then 24 hr. at 175° F., 75 percent R. H.; and finally 24 hr. at 175° F. and 100 percent R. H. We have used this test on flares of the three major cellulosic plastics and Fig. 9 shows the results. In evaluating the parts after the test, it was observed that the cellulose acetate and the softer cellulose acetate butyrate parts were too distorted to measure. The ethyl cellulose and the harder flows of the cellulose acetate butyrate were (*Please turn to page 162*)

***5**—These 11 cartridge-type flare cases served as test standards. **6**—These cases show the results of a 30-min. immersion in water maintained at 180°F. **7**—After a 3-hr. immersion in water at 180°F. the cellulose acetate and cellulose acetate butyrate parts were too distorted to measure. **8**—Results of a test at 210°F. for 48 hours*

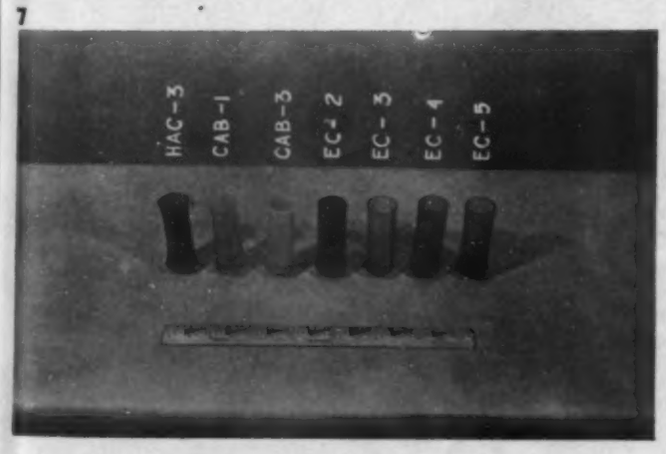
5 PHOTOS, COURTESY DEVELOPMENT & RESEARCH LAB., PLASTIC DIV., CELANESE CORP. OF AMERICA



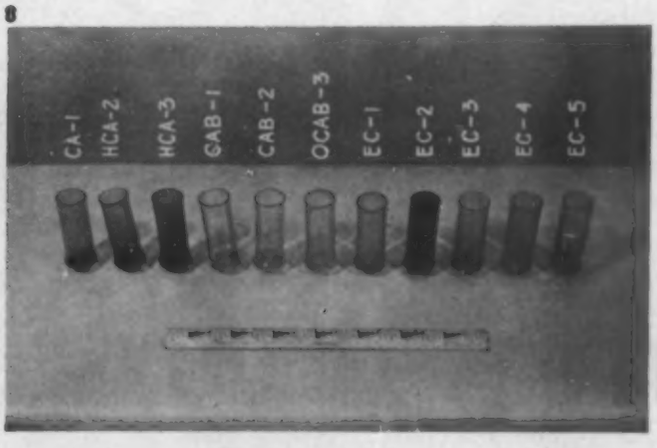
6



7



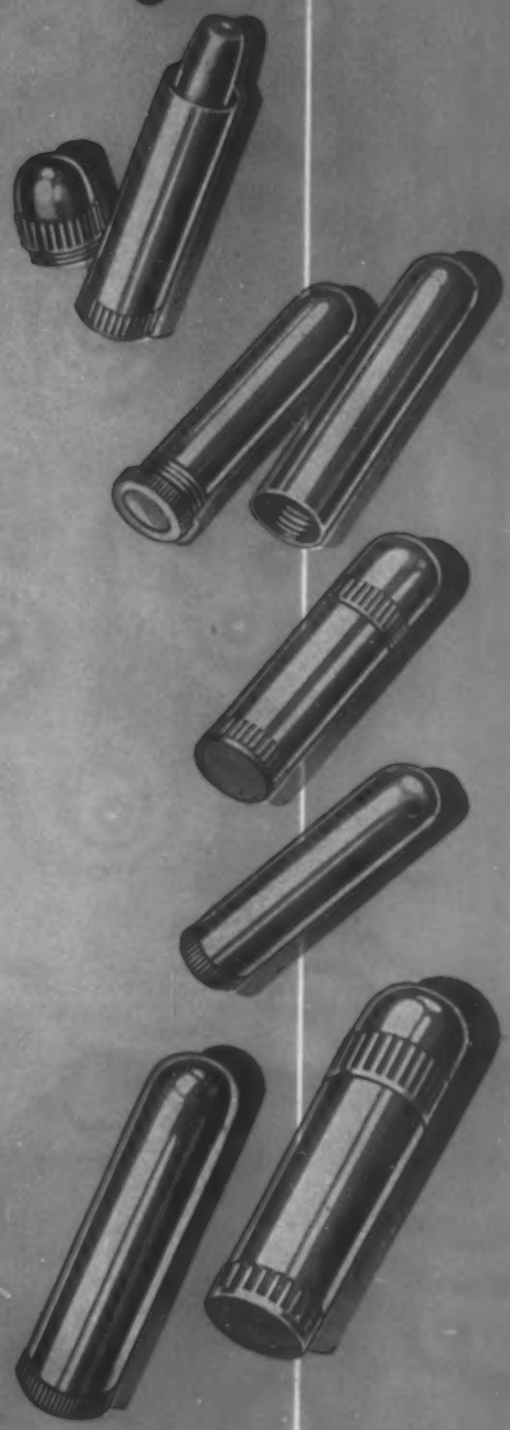
8



PLASKON DIVISION, LIBBEY • OWENS • FORD GLASS COMPANY

2121 SYLVAN AVENUE, TOLEDO 6, OHIO • Canadian Agent: Canadian Industries, Ltd., Montreal, P. Q.

Versatile Plaskon Again



Nasal inhalers of gleaming white Plaskon Molded Color . . . attractive and sanitary . . . demonstrate another essential use of versatile Plaskon plastic materials.

The value of Plaskon for molded therapeutic devices or containers is widely recognized by medical men in civilian life and Armed Force service. For any purpose, molded units of Plaskon are non-bleeding *in*, and completely resistant *to*, alcohol, acetone, and other common organic solvents. Molded Plaskon is unaffected by oils and fats; and is odorless, tasteless and inert. It has a smooth, colorful, eye-catching surface that is warm to the touch.

Plaskon has high flexural, impact and tensile strength. It is completely resistant to arcing and tracking under high voltages and high frequencies. For the development of post-war products, Plaskon offers you exceptional manufacturing and sales advantages. Right now, our ability to supply Plaskon depends directly upon W. P. B. Allocation Order M-331.

PLASKON

TRADE MARK REGISTERED

★ MOLDED COLOR ★

Simplicity marks the setup of heatronic molding equipment with electrodes and oscillator placed adjacent to the press

New application of heatronic molding

SINCE "heatronic" molding first was discussed in the Engineering Section of MODERN PLASTICS, the magazine has attempted to keep abreast of all new developments in this process. There has been much discussion among electronic engineers responsible for equipment design as to just which frequency gives the best results. Work has been done at 2 megacycles on plywood and as high as 28 megacycles on high-impact phenol formaldehyde materials. Other frequencies within this range also have been used. In addition there appears to be a difference of opinion as to the type of circuit that should be employed to achieve the best results.

These questions, however, are of a highly technical nature and are best left for the discussion of electronic engineers. Molders are interested in results and, while the use of high frequency equipment and its application to molding methods have presented many difficulties, the majority of these problems have been overcome. Points of interest to the molder are savings of time and money, and better quality products with higher strengths. With these considerations in mind we shall confine ourselves to the reporting of facts and the results of such applications as actually are in production.

The most recent example of the successful use of high frequency heating of phenolic materials is a brush holder in the control mechanism of a controllable pitch propeller. Since the part is of a confidential nature only a brief description may be given. The holder is a segment of an arc approximately 4 in. long, 2 in. thick and 2 in. wide. The projected radius is approximately 8 to 10 in., and its section is studded with 24 square, hollow brass inserts.

There were many factors including its shape that made this part a difficult one to mold. In early attempts to mold the part, difficulties with cracking and warping always resulted. The warping seemed to be prevalent even at normal room temperatures. When these brush holders were subjected to temperatures ranging from −40 to +170° F., almost none of them remained true. In accelerated tests run by the purchaser, the parts were heated in an oven at 350° F. for a short period, and in nearly every case the holders failed to stand up under the test. A standard hand transfer set-up was arranged for the molding of the part, but even with a 30-min. cure the accelerated test caused warping. It is true that 15-min. curing time gave a standard acetone extraction, but this time was used in an effort to eliminate warpage.

With standard infrared preheating, 15 min. of curing time and 2 min. for pot closing was necessary. However, when the preforms were preheated between the electrodes of a 5-kw. high-frequency oscillator for a period of 40 sec., the molder discovered that the pot closing time could be cut to 10 sec. and the curing time to 2 minutes. With this greatly reduced curing time the acetone extractables remained about the same, but the quality of the part was greatly improved. Checked at −40 to +170° F., none of the parts showed warpage, and when given the accelerated text at 325° F. the brush holders neither warped nor cracked.

The soft and spongy condition of the material after preheating can be seen in Fig. 3 where a preform is being removed from between the electrodes of the oscillator. The cabinet which houses the electrodes is so constructed that

the current cannot be turned on unless the door is tightly closed. Conversely, the current shuts off as soon as the glassed door is opened. The oscillator is equipped with a similar safety device which makes it impossible for the current to be turned on when the front panel is open as in Fig. 5.

Figure 1 illustrates the simplicity which is inherent in the use of this type of equipment. The electrodes are placed immediately adjacent to the press so the operator merely has to open the cabinet door, remove the preform from between the electrodes and drop the preheated material into the transfer pot. Since the entire operation takes but a few seconds it in no way slows up the molding job. A close-up of a standard hand transfer setup with the pot plunger permanently assembled to head of press can be seen in Fig. 4.

The oscillator used in preheating material for the brush holder is said to be capable of preheating standard phenol formaldehyde material either high impact or standard wood-flour, at the rate of $2^1/_2$ lb. per min. from ambient temperature to approximately 250° F. when operating at a frequency of $27^1/_2$ megacycles. For convenience it is installed adjacent to the electrode cabinet.

In this case high frequency equipment has done more than save time and labor—it has made possible the production of an important aircraft propeller part which had appeared to be a failure by other methods of molding.

Credits—Material: Bakelite. Molded by Boonton Molding Co.

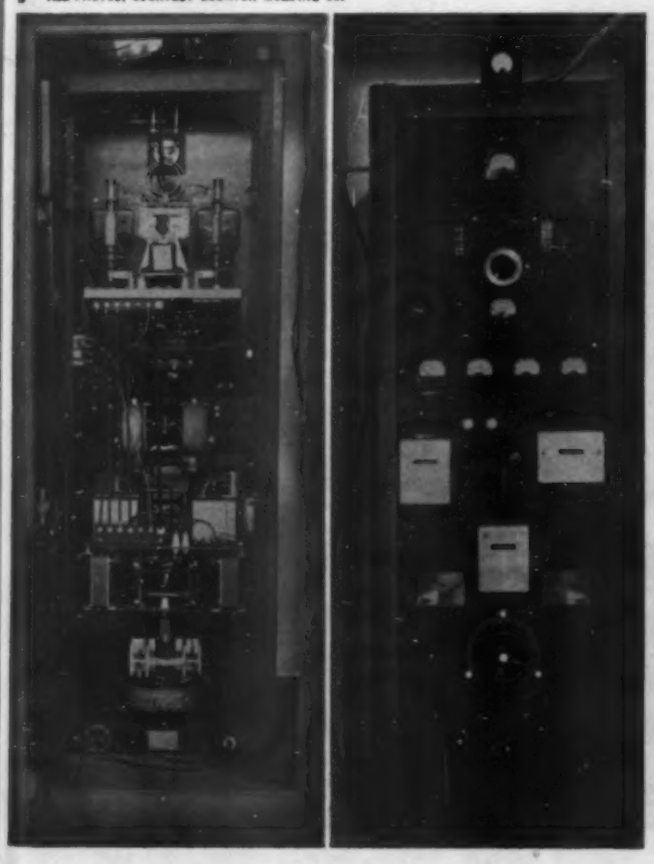
2

3

4

2—The cabinet which houses the electrodes of the high-frequency oscillator is so constructed that the current cannot be turned on except when the glassed door is closed as it is in this illustration. 3—Material is in a soft and spongy condition after preheating. 4—A preheated preform being placed in transfer pot. 5—Close-up of oscillator with its door open and with it shut

5 ALL PHOTOS, COURTESY BOONTON MOLDING CO.



Life On The

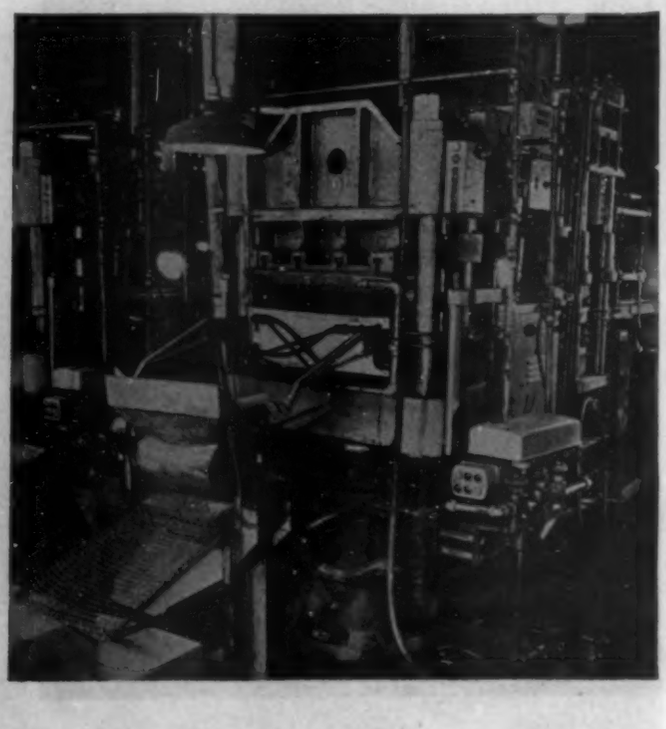
(*Left*) **PLASTICS DEVELOPMENT** is carried on in the Stamford Research Laboratories of American Cyanamid with the aid of the most modern equipment. This program of experimentation and testing is conducted by Cyanamid in a constant effort to widen the usefulness of plastics and formulate new materials to meet new and unusual requirements.

One of the latest products of Cyanamid research is LAMINAC*, a thermo-setting liquid resin which so simplifies building up wet fabric in a mold as to make possible the production of laminated pieces in extremely complicated shapes. Remarkable bonding strength at mere contact pressure is a feature of this new resin — excellent laminates may be produced by using contact pressure between steel or glass plates, or simply by wrapping about a mold under tension. Rapid curing time, easy impregnation of fillers, and the exceptionally high strength of resulting laminates made LAMINAC well suited for the production of flat or curved objects by low-pressure molding methods with relatively inexpensive laminating equipment.

Further information about LAMINAC, or the Cyanamid plastics and resins mentioned on these pages will be supplied promptly on request.

(*Below*) **AN ARMY "BLUE PLATE"** for serving soldiers of Uncle Sam's Army Medical Corps is this compartment tray developed by American Cyanamid in cooperation with the Quartermaster Corps. Molded of MELMAC* P-3020—a chopped-cotton-fabric-filled material, it combines lightness with unusual surface hardness and strength. In addition, MELMAC P-3020 offers the advantages of high resistance to hot or cold water, stains and abrasion—factors that contribute to sanitation and attractiveness.

(*Below*) **A PREVIEW OF MOLDING PROGRESS** is seen in this fully automatic molding press which makes ninety-six 28 mm. BEETLE* closures every forty-five seconds. Developed by the Boonton Molding Company, it weighs, preforms, preheats, molds and tumbles to remove flash. The closure produced is described as unique because it has a ledge above the thread behind which the liner is tucked. No glue is needed to keep the liner in place. This press can also be used to mold larger pieces such as radio cabinets.



Plastics Newsfront

(*Right*) **AN ATTRACTIVE PACKAGE** is provided of molded BEETLE for these inhalers of the Vick Chemical Company molded by the Waterbury Button Company. BEETLE was specified for the containers primarily because of its superior resistance to attack from the chemicals used in the medication. Now restricted to essential civilian or wartime applications, BEETLE offers a unique combination of characteristics at comparatively low cost. It is strong, durable, and light in weight. It is insulating, odorless, tasteless and sanitary. BEETLE enables the experienced molder to supply packaging needs quickly because it is fast, uniform and economical in production.

Still different packaging requirements are met by MELMAC, another product of Cyanamid research. This new plastic offers extremely low moisture absorption, is impervious to prolonged immersion in boiling water, is chemically inert, non-staining, and highly resistant to nearly all common chemical agents.

Both BEETLE and MELMAC will be available in color after the war, both will give the designer new opportunities and greater freedom in transforming functional and decorative ideas into practical reality.

(*Above*) **INDISPENSABLE GUIDES** to both the Army and Navy, maps are subjected to rough treatment; must resist sunlight, rain, folding and tearing, and at the same time be clear enough to reveal the most minute contour lines. To strengthen maps —as well as paper packages and bags— Cyanamid's wet-strength melamine resins are used. The resulting maps can be washed free of mud, grease and dirt and restored practically to new condition.

(*Above*) **THE POUNDING ACTION OF SURF** for twenty-four hours failed to destroy this paperboard container or damage its contents, according to recent tests made by the Robert Gair Company. Cyanamid's URAC* resin, a urea formaldehyde modified resin, is used in the manufacture of such boxes to strengthen, make water-resistant, and "weatherproof" them. A laminating process is used similar to that for making plastic bonded plywood.

OFFICIAL PHOTO FROM OWI

(*Above*) **SMOOTHING THE EDGES** on ten-inch plastic plates for Navy use. Tableware made out of MELMAC 1077 is replacing less durable types of dishware which are susceptible to breakage during rough weather and heavy gunfire. MELMAC 1077 is clean and sanitary because of its hard, moisture-resistant surface.

*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
CYANAMID PLASTICS · Beetle · Melmac · Urac · Melurac · Laminac

In redesigning the housing of this tapping attachment to employ plastics instead of cast aluminum, the principle difficulty was the close center-to-center tolerance demanded of all the assembly holes. As a final solution, all the important holes were molded undersize and then brought to size by drilling

Housings for tapping attachments

UNTIL about a year ago a large quantity of cast aluminum was used in the manufacture of housings for various sizes of tapping attachments by the Ettco Tool Company. When aluminum became very strategic, WPB issued instructions that some less scarce material be used as a replacement. At that time plastics materials were far less strategic than they are today, and a conversion from aluminum to plastics was decided upon.

There were many factors to be taken into consideration in the redesign of these tapping attachments. Since the units are assembled directly into drill press spindles, weight could not be overlooked. In addition, strength and durability were a necessity for these attachments. It was conceded that difficulties would result if an attempt were made to mold all the holes since the tolerances on the center-to-center distances are very close. However, orders were given to proceed with two 2-cavity molds designed for the molding of all holes. One mold was for the top half of the case and the other mold for the lower section.

No sooner were these molds completed and samples made than trouble began to develop. Due to variation in the center distances, difficulty was experienced in assembling the units. In addition, breakage occurred in some housings at the $1^1/_2$-in. threaded hole in the top half of the case. The white arrow in Fig. 2 indicates the trouble point. In explaining this failure the molder states that "when we originally produced the tapper housings we used a medium high-impact phenolic material. This plastic was satisfactory for the application except that breakage occurred in some of the cases across the rim at the $1^1/_2$-in. threaded hole. In order to eliminate this failure and insure against future breakage, the material was changed to a high-impact type."

Fortunately, when the dies were designed, breakage difficulties were anticipated. For this reason the "positive" or "loading space" was made sufficiently deep so that if it were found necessary to use a material with a very high bulk factor in order to strengthen the part, there would be no necessity for tool changes.

The molder still was faced with the problem of controlling the variation of the center distances of the assembly holes. While these differences were not out of line with normal molding tolerances, they were too great to permit proper assembly and operation in a precision instrument such as this tapping unit. The final solution to this problem was found in molding the important assembly holes undersize and then bringing them to their proper size and within the necessary tolerances by precision jig drilling. Accuracy thereby was obtained. As a result the majority of the thousand aluminum cases which the company had withheld for use in case the plastic conversion was unsuccess-

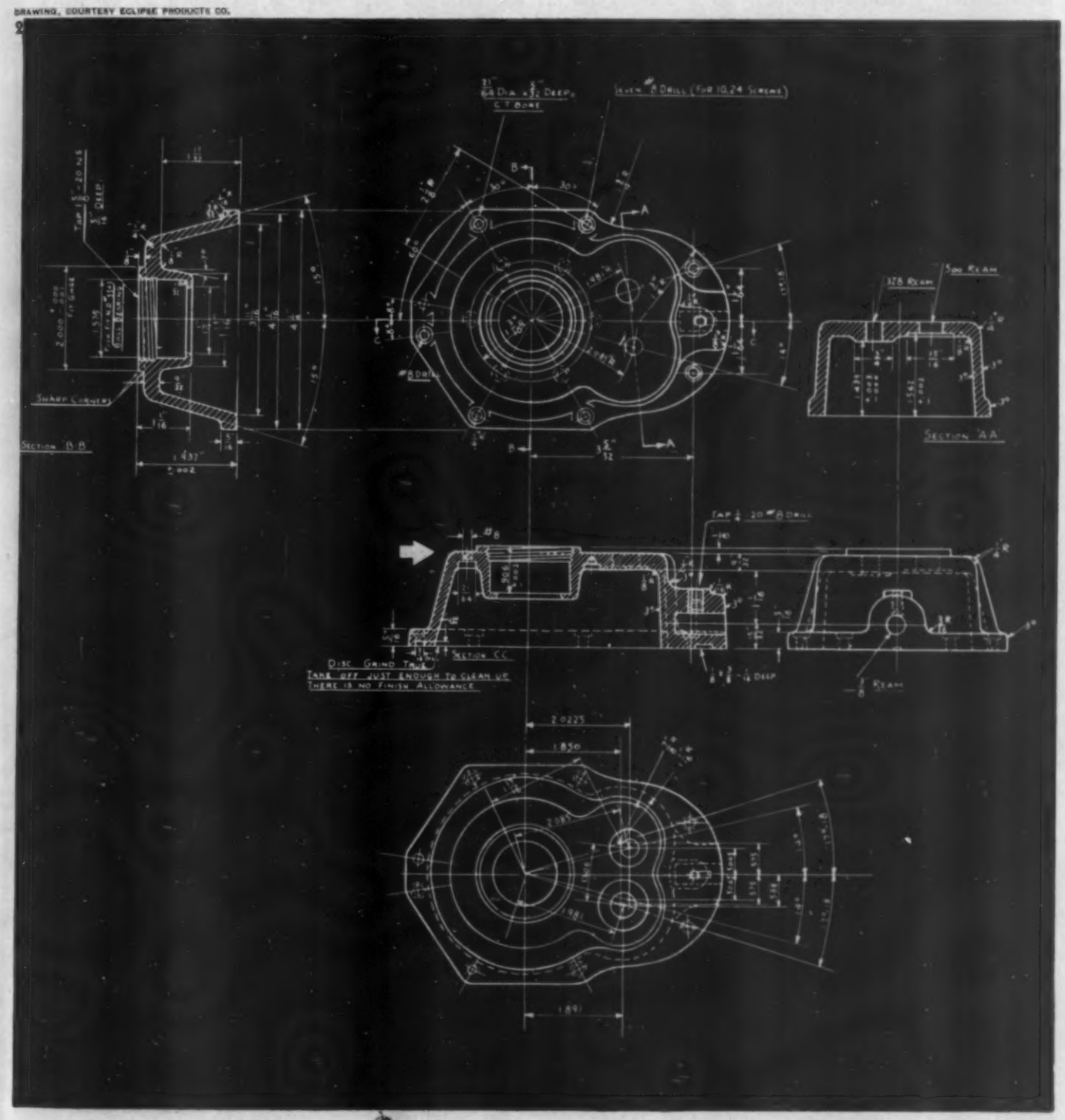
ful and upon which they had drawn pending solution of the various molding problems still are in stock.

The actual molding technique is practically standard with this type of heavy wall section job. Preforms are cold molded by hand and after a short preheat under infrared, the material is compression molded with a normal curing cycle dictated by the average wall section which approximates $^{9}/_{32}$ inch. At this point both molder and tool company felt that all obstacles had been surmounted and they had no further worries but those of producing and selling tapping attachments. On the contrary, one of the most difficult problems was yet to be solved. Heavy opposition was encountered when the company's customers were informed that the tapper units no longer would be delivered in aluminum cases but, in the future, would be equipped with housings molded of plastics. It is ironical to note that one of the purchasers has a large molding plant of its own.

The sturdy construction of the phenolic casing of this tapping attachment eventually overcame all sales resistance. Today even the most skeptical purchasing agent has agreed that the housing is as good—if not better—than its aluminum predecessor. To win this acceptance the case has had to withstand not only normal usage and handling but severe treatment such as is not usually applied to plastic materials. The approved method of disassembling this unit from the drill press spindle is through the use of a drift pin. However, workers often find this procedure too slow and drive the unit out of the spindle by hitting the plastic case with a

2—The white arrow in this work drawing of the top half of the tapping attachment housing, indicates the point where breakage occurred before high-impact phenolic material was substituted for original medium high-impact type

DRAWING, COURTESY ECLIPSE PRODUCTS CO.



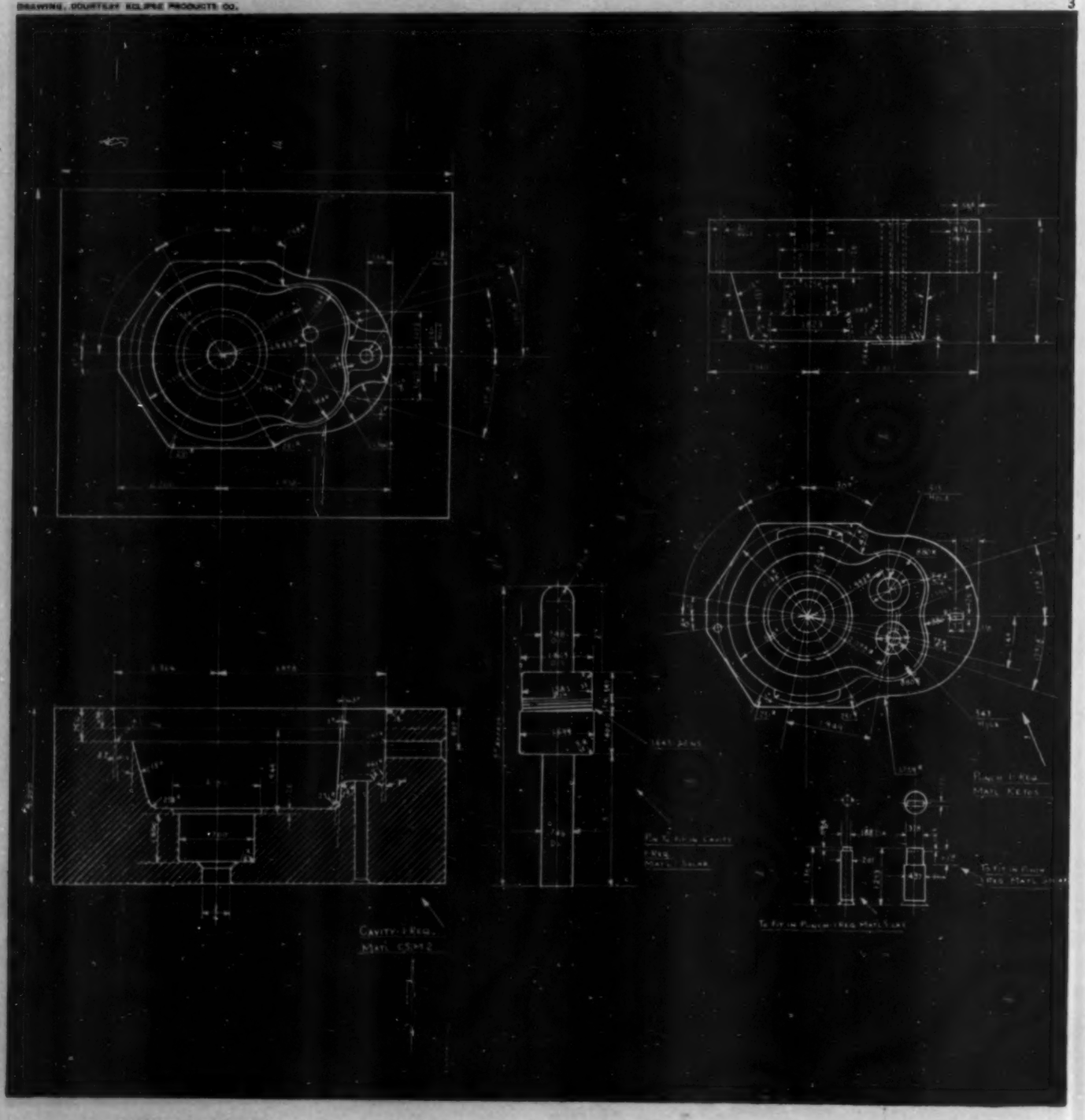
hammer. Although this method is not recommended it demonstrates the ability of the housing to "take it." Further verification of the strength of the molded case lies in a statement by the tool company that they have received no complaints of the housing cracking even when the entire unit has been dropped on a concrete floor. An accident of this type in the case of an aluminum holder would have necessitated the return of the entire unit to the factory for repair.

Another unique feature in the treatment of the plastic tapping attachment was brought to light in the repair department maintained by the tool supply house. When a tapper unit is returned for repairs it is first put through a degreasing unit in order to wash out all dirt and grease. It has been found that the plastic cases can withstand immersion in the degreasing liquid which is maintained at a temperature of 215° F., without warpage or other undesirable effects.

It is true that this case was not developed overnight. In fact, the first plastic housings were a marked failure. But during a long period of development the difficulties were ironed out one by one, and the parts gradually were improved until a successful unit was obtained. Due to the success of this conversion and to the cooperation received from the molder, this company which had practically no previous experience with plastics, is considering plans to convert 2 additional sizes of tappers to phenolic housings.

Credits—Material: Bakelite. Molded by Eclipse Products Co. for Elco Tool Co.

3—*On the left (top to bottom) are the plan view and cross section of the cavity for the top half of the attachment housing while on the right (top to bottom) are the elevation and plan views of the punch for the top half*



The ARNOLD Brilhart COMPANY

Through the use of the NEW HM-119 Heat resistant "LUCITE" by DuPont presents startling new developments in the injection molding of component metal-plastic parts.

These new methods coupled with the superior specifications of H M-119 "LUCITE" will prove invaluable to the Electronic and Plastics Industry.

Additional information on this new technique and its application to your problems will be sent on request...

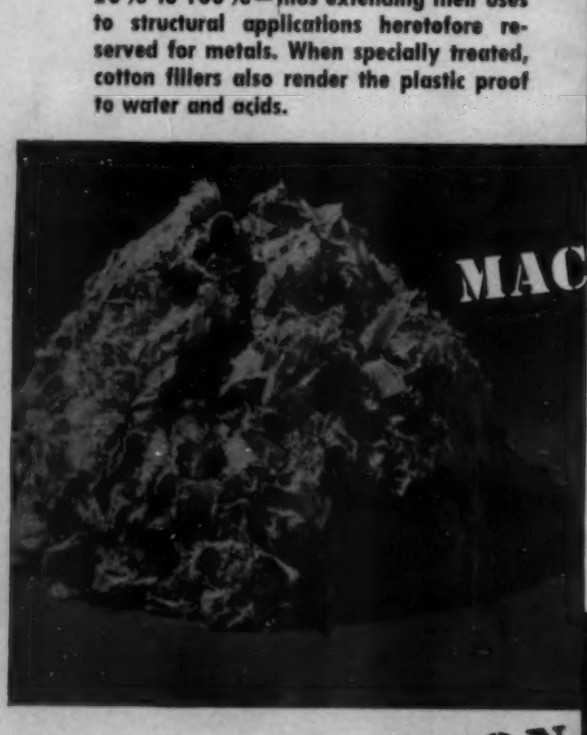
ARNOLD BRILHART LTD. 435 MIDDLENECK RD. GREAT NECK, N.Y.
TELEPHONE :- GREAT NECK 4054

COTTON CABLE CORD

Claremont fillers are the muscle builders of thermosetting plastics. When specifications call for a material with greatest impact, flexural and tensile strengths, the use of Claremont's cotton cable cord is unreservedly recommended.

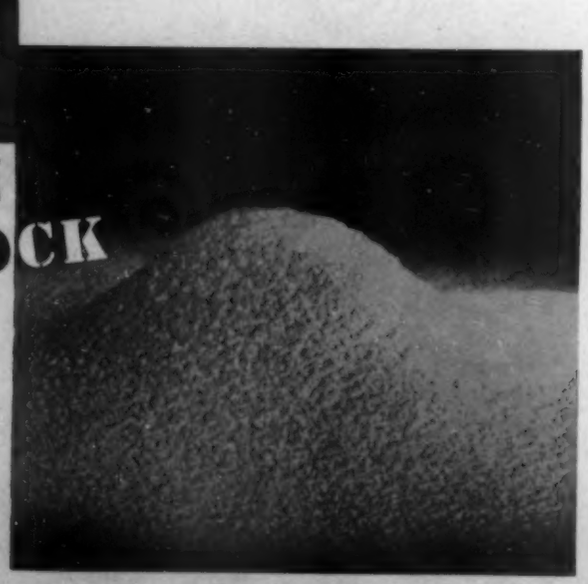
CHOPPED COTTON THREAD

Claremont precision-cut, identical lengths of strength-giving cotton thread. Strength increases due to cotton fillers range from 20% to 100%—thus extending their uses to structural applications heretofore reserved for metals. When specially treated, cotton fillers also render the plastic proof to water and acids.



MACERATED KHAKI FABRIC

Claremont's macerated khaki fabric is a tough, uniformly composed filler with longer, cleaner, more uniform fibres. This type assures a smoother, better flow and fewer rejects.



COTTON FLOCK

Claremont cotton flock — stronger than wood flour—Uniform bulk and fibre length. Free of all foreign matter. Claremont facilities not only qualify to serve your present requirements, but also welcome the opportunity of working with your research staff in developing even tougher materials for future plastic progress.

CLAREMONT WASTE MANUFACTURING CO.

CLAREMONT, NEW HAMPSHIRE

Injection molding of nylon

by R. B. AKIN† and J. E. TEAGARDEN*

THE group of polymeric materials known as nylon includes individuals of widely differing physical and chemical properties. Nylons have become best known in the form of fine and coarse filaments for such uses as hosiery, parachutes, racket string, surgical sutures, and bristles in toothbrushes, hair brushes, and industrial brushes. As plastics, they are of comparatively recent development, but already various types have been found well suited for use in extruded and molded goods. Great progress has been made in adapting the standard operations of extrusion, compression molding and injection molding to the peculiar thermoplastic properties of nylons.

The present article deals with the injection molding of nylon, particularly that of the nylon known as FM-1.[1] The information presented should assist in determining the suitability of nylon for current military uses and for general use as a plastic after the war. All nylon is completely under allocation by the WPB, and military requirements have been such as to preempt both material and research effort which would have been devoted to more extensive development and commercial evaluation of injection-molded nylon.

Its commercial use thus far has been limited to a few specific military applications. Only small quantities are available for examination with respect to additional uses. Both this material and the technical services of its manufacturer must currently be restricted to demonstrated military needs. Some of the present uses of this material are under restrictions of military secrecy. Some others are illustrated herein. The sprues and runners shown on these pieces, molded in inserts in existing die-blocks, are much larger than necessary or recommended.

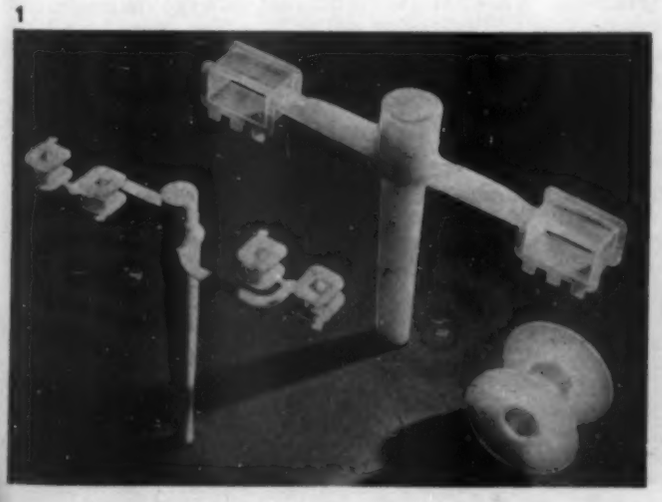
Figure 1 shows spools about which are wound coils for actuating aircraft instruments. Nylon is used in this application because it resists operating temperatures which distort other thermoplastics. The wall thickness is only 0.012 in., far less than would be required with thermosetting molding powders to provide the toughness needed during assembly operations. The opposite sides of the smaller spools can be forced together until they meet; when released, they almost instantly resume their original shape. Fig. 4 shows a Switchette housing, molded for General Electric Co., in which nylon provides the same advantages as in the coil forms which are pictured in Fig. 1.

The slide fastener pictured in Fig. 2, is molded from nylon. In this use the material shows immunity to dry-cleaning solvents, and it is unharmed by temperatures of ironing. The fluidity of nylon at time of injection is such as to permit its entry into fibers of the cloth tape to form a bond, and makes unnecessary the subsequent cementing operation customary with other plastics used for this purpose. The strength of the bond to the tape in this particular application exceeds that of cellulose ester teeth which have been cemented in place. (*Please turn to next page*)

† Engineer, Technical Service Group, Plastics Dept., E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.
* Engineer, Research Dept., Plastics Dept., E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.
[1] A molding compound manufactured by the Plastics Dept., E. I. du Pont de Nemours & Co., Inc.

1—These spools around which are wound coils for actuating aircraft instruments, are examples of the type of articles which are being injection-molded of nylon and suggest many interesting postwar uses. 2—The injection-molded nylon slide fastener shows immunity to dry cleaning solvents and is unharmed by ironing temperatures

1



2

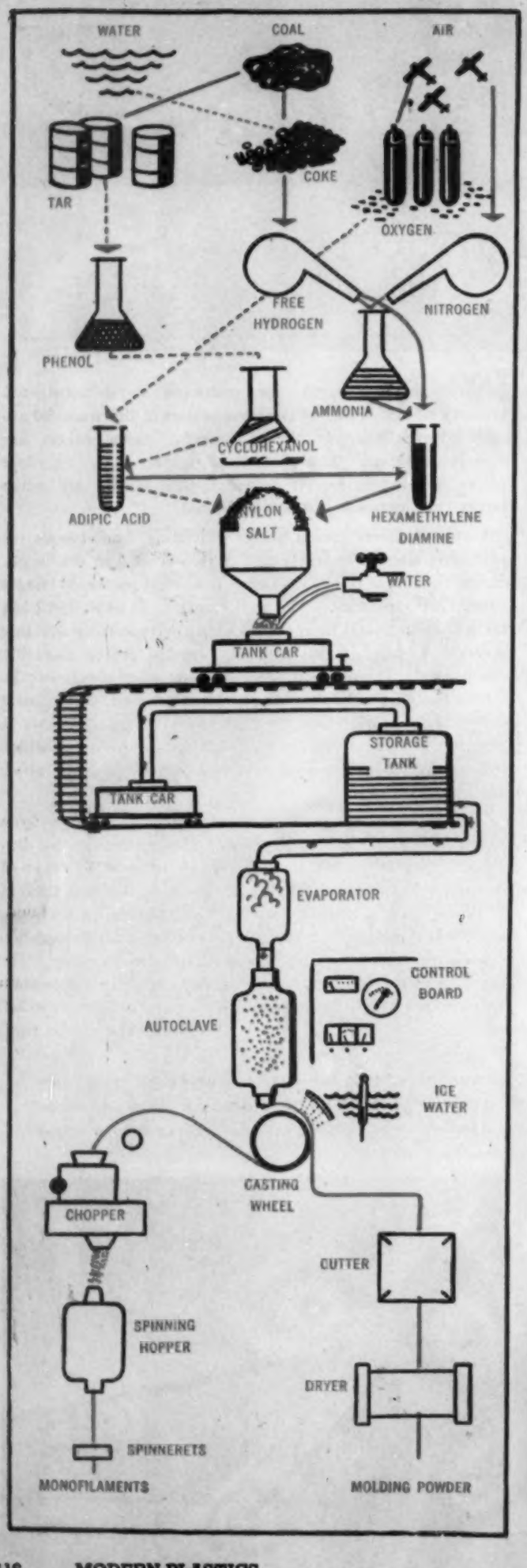


TABLE I.—DIMENSIONAL STABILITY OF FM-1 NYLON

Specimen	Wall thickness	Shrinkage parallel to injection after 150-hr. heat treatment at 167° F.	at 250° F.	at 350° F
	in.	in./in.	in./in.	in./in.
Bushing:				
19/16 × 15/16 × 2 in.	5/16	0	0.0011	0.0027
19/16 × 3/4 × 2 in.	13/16	0	0.0023	0.0047
Disc:				
6 in. diameter; center-gated	1/8	0.0017	0 0034	0.0150
Disc:				
4 in. diameter; edge-gated	1/8	0.0015	0.0099	0.0120
Tensile bar	1/8	0.0078	0.0117	0 0150

Properties of nylon FM-1

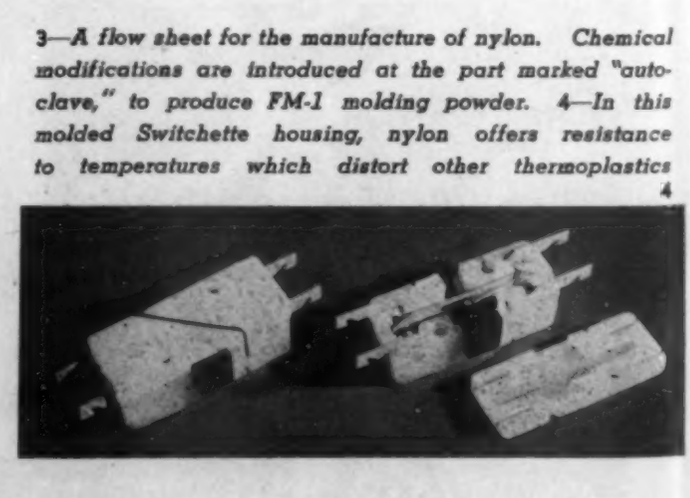
FM-1 nylon molding powder merits consideration where importance is attached to toughness, high softening temperature and the ability to be injected in thin sections and to flow around complicated inserts. Molded pieces of FM-1 nylon will be attractive because of their mechanical properties rather than their appearance. This material has a translucent light cream color. The lack of effective solvents for this nylon makes the incorporation of dyes a difficult problem, and colored molding compositions are not yet available. Moldings may be dyed by aftertreatment. Although the penetration by the dye is shallow, the hardness and abrasion-resistance of the pieces are such that the coloration may be durable enough for some purposes.

The resistance of the material toward ordinary solvents results also in the lack of a satisfactory technique for cementing it. Phenol and its homologs give a fairly satisfactory joint but are objectionable because of their corrosive nature. Nylon of this type cannot be made flexible by incorporation of plasticizers. It is insoluble, not only in common organic solvents but also in alkalis and weak mineral acids. It is dissolved by molten phenol and by formic acid, and is attacked by strong acids which cause hydrolysis into amine and dibasic acid constituents.

Nylon is thermoplastic in the sense that it can be softened by heating, made rigid by cooling and resoftened by heating again. But it does not show progressive increase in plastic flow and decrease in tensile strength, as temperature is raised, to the same extent as do the ordinary thermoplastics such as cellulose acetate and the acrylics. In common with nylons of the types used in yarns and filaments, FM-1 nylon shows marked tendency to crystallinity. For that reason its behavior at its softening temperature is much different from that of thermoplastics which have no single softening temperature but simply become less and less viscous as temperature rises. While FM-1 nylon does not show the "unmolding"

3—A flow sheet for the manufacture of nylon. Chemical modifications are introduced at the part marked "autoclave," to produce FM-1 molding powder. 4—In this molded Switchette housing, nylon offers resistance to temperatures which distort other thermoplastics

4

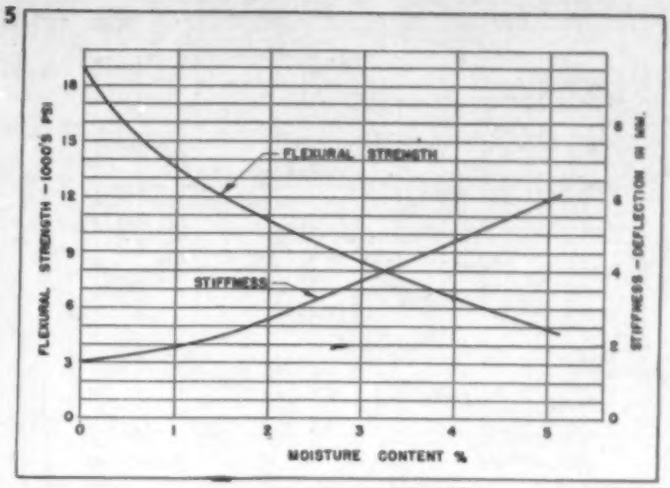


of other thermoplastics until its temperature has been raised to about 450° F., it should not be subjected to temperatures above 275° F. under load. Nylon moldings kept above 300° F. for a long time undergo discoloration and loss of toughness. The extent of loss will vary with the temperature and contact with oxygen. The dimensional stability of FM-1 nylon at elevated temperatures is indicated in Table I.

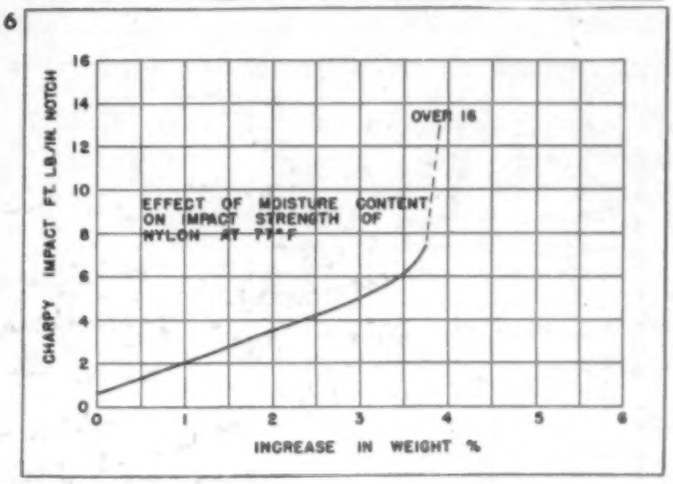
In the presence of moisture, nylon moldings undergo dimensional changes to an extent which depends greatly on the shape of the article. In general the dimensional stability toward moisture is only fair. For example, an impact bar 5 in. × 1/2 in. × 1/8 in. is increased in length by 0.008 in. per in. in going from zero moisture content to saturation. Since in thin sections stresses locked within nylon pieces at the time of molding are relatively small because of the fluidity of the material at that time, moisture usually causes less dimensional change in a nylon article than in a molded article of a cellulose ester.

Typical properties of FM-1 nylon are given in Table II. The test method used was in all cases that of the A.S.T.M. unless otherwise designated. The superscript numbers in the data refer to deviations from the accepted test methods. The following comments will be of interest in reviewing the tabulated physical properties. The tensile strength does not represent a point of rupture but rather the fiber stress at which orientation of the molecules begins to take place. This orientation is accompanied by elongation along the axis of stress to about 4 times the original length. Thereafter, the tensile strength may reach 60,000 p.s.i., and

5



6

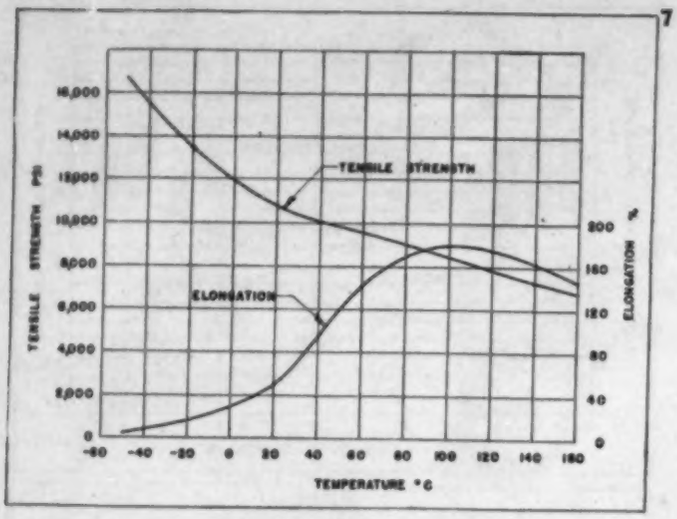


5—Graph showing flexural strength and stiffness of FM-1 nylon vs. its moisture content. 6—Moisture content of FM-1 nylon vs. impact strength is traced in chart

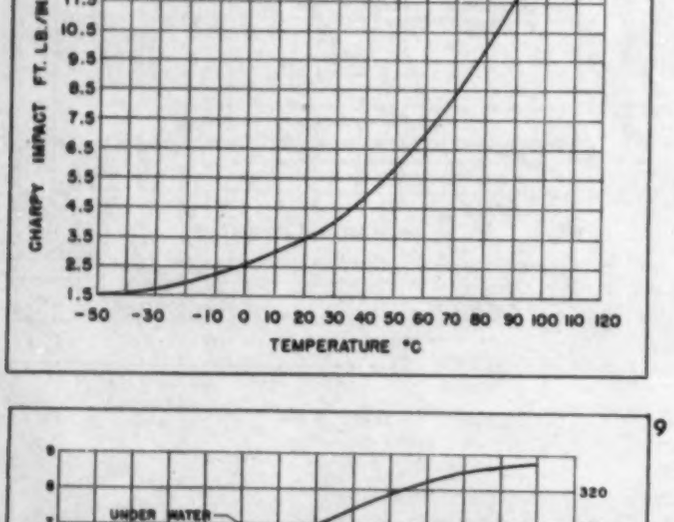
Table II.—Typical Properties of FM-1 Nylon

Property	*Test method*	*Test result*
Specific gravity	D71–27	1.14
Tensile strength —70, 77, 170° F., p.s.i.	D638–42T	16, 620[c]; 10, 530; 9, 290[b]
Elongation —70, 77, 170° F., %	D638–42T	3[a]; 54; 145[b]
Modulus of elasticity, 77° F., p.s.i.	D638–42T	325, 500
Flexural strength, 77° F., p.s.i.	D650–42T	12,600–14,600
Stiffness, 77° F.	Arlington M-9	1.89–2.02[e]
Impact strength, Izod —70, 77, 170° F., ft. lb./in.	D256–41T[h]	0.418; 0.944; 0.968
Rockwell number	Arlington M-29	100 L; 65 H
Creep in flexure	Arlington P-25	89[d]
Deformation under load, 122° F., %	D621–41T	4.0
Heat distortion temperature, ° F.	D648–41T	149
Heat distortion temperature, low load, ° F.	D648–41T	403[c]
Specific heat, cal./gm./° C.	.....	0.55
Coefficient of expansion per ° F.	D696–42T	5.7×10^{-5}
Thermal conductivity, B.t.u./hr./ft.²/° F./in.	D325–31T	1.74
Dielectric strength, short time, V/M	D149–39T	400
Dielectric strength, step by step, V/M	D149–39T	300
Volume resistivity, ohm-cm.	D257–38	10^{13}
Dielectric constant, 60, 10^6, cycles	D150–41T	3.8[f]; 4[g]
Power factor, 60, 10^6, cycles	D150–41T	1.8[f]; 5[g]
Water absorption, %	D570–42	7.3
Flammability, in./min.	D635–41T	Self extinguishing
Methods of working		Injection, compression, extrusion
Basic color		Light cream
Resistant to		Esters, ketones, alkalies, alcohols, common solvents, weak acids
Not resistant to		Phenol, formic acid, concentrated mineral acids
Outstanding for		Toughness, high temperature resistance, ability to injection mold into thin sections
Major uses		Heat-resistant parts

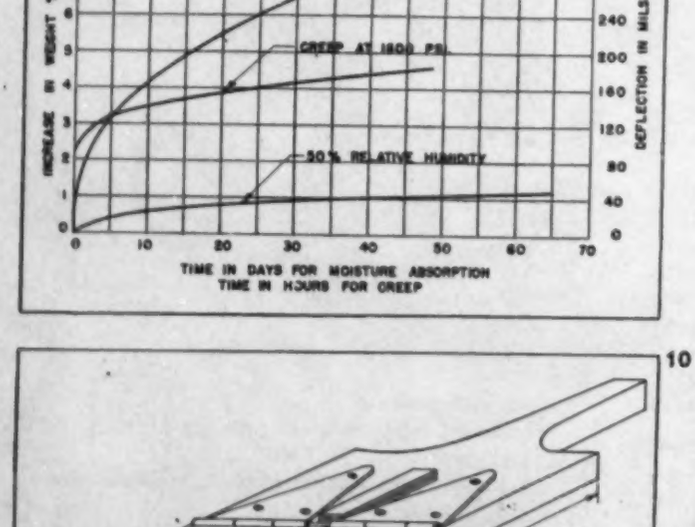
[a] —58° F. [b] 140° F. [c] Millimeters deflection at 0.125 in. thickness. [d] Mils after 48 hr. at 1600 p.s.i. and 77° F.—original deflection.
[e] 64 p.s.i.—D648–41T mod. [f] 33° C. dry. [g] 22° C., 18% RH, 10^3 cycles. [h] Type R conditioning.



7



8



9

10

the oriented piece is considerably stiffer than the unoriented. Obviously this orientation can be carried out practicably only in a filament, and hence the high tensile strength associated with the better-known forms of nylon cannot ordinarily be attained in molded articles.

Although its indentation hardness, as measured by the Rockwell or similar methods, exceeds that of methyl methacrylate, nylon is horny rather than brittle. This resilience coupled with a low coefficient of friction and relatively great hardness makes nylon moldings quite resistant to abrasion. The impact strength is in the neighborhood of that of fabric-filled phenolic molding compositions. As the temperature is lowered, nylon moldings retain their impact strength quite well. At −50° F. the decrease in impact strength is appreciable, but the strength still exceeds that of molding compositions which depend on plasticization for impact-resistance. Although the melting point is high, there is a loss of rigidity with rising temperature.

The effects of moisture content and temperature on various physical properties are shown in Figs. 5 to 9. The relation between the load on the specimen and the heat distortion temperature is shown in Fig. 11. The volume resistivity of the nylon in thin sections is 10^{13} ohm-centimeters at 50 percent relative humidity and about 5×10^{9} ohm-centimeters at 100 percent relative humidity. This change is due, of course, to the absorption of moisture by the nylon and is reversed by drying.

When properly molded, nylon is so tough that conventional methods of test fail to measure this property satisfactorily. It has been found, however, that there is likely to be a considerable variation in toughness between molded pieces which should be the same. More significant than the absolute value of toughness in the best pieces is the proportion of pieces which fail to possess the toughness which they should. The accurate measurement of this variability necessitates the testing of a large number of specimens. For this purpose a special test has been devised which enables this to be done with a minimum expenditure of time and material. The simple equipment for this break test is shown in Fig. 10. Twenty-five test bars, 5 in. × 0.5 in. × 0.125 in., conditioned for 24 hr. at 77° F. and 50 percent relative humidity, are tested by being bent through 180 degrees around a ¼-in. round bar in this equipment, each one at 4 points in its length. A lot of FM-1 nylon is considered satisfactory if there are not more than 8 breaks in the 100 bends thus made. The toughness is stated in terms of the "hand-break number" which is 100 minus the number of breaks. "Lucite" methyl methacrylate or "Plastacele" cellulose acetate #52100 similarly tested give 100 breaks in 100 bends.

The effect of moisture is important with all conventional molding powders and is even more so with nylon molding powder. Moisture in the molding powder causes a sharp reduction in the inherent toughness of molded pieces as well as being harmful to surface. Since the material picks up moisture rapidly, the predried nylon is packed for shipment in small moisture-proof drums from which it can be used by the molder with minimum exposure to the atmosphere. Another factor influencing the toughness of the molded piece is the particle-size of the molding powder. As shown in

7—Curves showing tensile strength and elongation vs. temperature of FM-1 nylon. 8—Chart of impact strength vs. temperature. 9—Graph indicates the creep and moisture absorption of nylon vs. time. 10—A drawing of equipment devised for the break test as a time- and money-saver

Fig. 12, the best results are obtained from material of intermediate particle size. Fine material gives poor results, presumably because it presents greater surface for oxidation during its passage through the heating cylinder. Fine material mixed with that of optimum size impairs the quality of the moldings obtained from the latter. Sprues and runners from molded pieces may be cut up and molded again, but the resulting molded pieces are markedly less tough than those from virgin material.

Among molding powders of high impact strength, nylon has the outstandingly low density of 1.14 grams per cc. as against the 1.27–1.56 of cellulose acetate and the 1.4 of fabric-filled phenolics. The low density in some measure offsets the present high pound-cost of nylon molding powder. Progressive reductions in the price of powder will be likely as the production becomes greater.

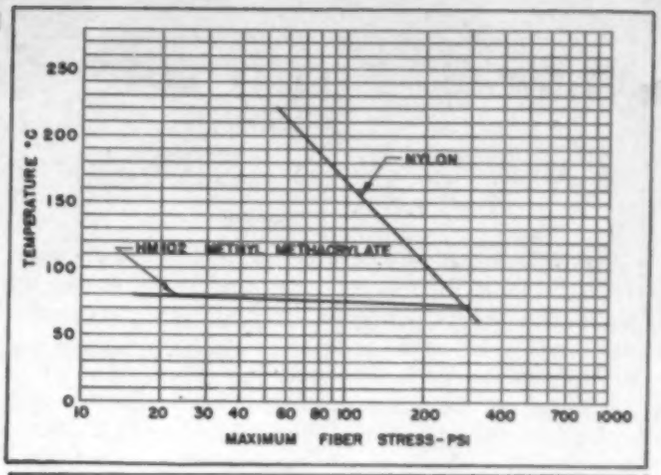
Molding technique for nylon FM-1

FM-1 nylon requires a high injection temperature, melts sharply to a fluid condition and sets quickly. Since temperatures required are enough to cause incipient charring of all organic materials, nylon in an injection cylinder should not be heated hotter nor for longer than is required to melt it completely and to provide a margin of temperature above the melting point which will prevent premature solidification of the liquid entering the die. Because of the sharpness of the melting point, the fluidity at the time of injection cannot be controlled by adjustment of temperature as with other thermoplastics. The fluidity of the material is so much greater than that of conventional plastics that special precautions and equipment are required, but it is a distinct advantage when delicate inserts are used. The quick setting promotes a short cycle but necessitates close control of temperature to avoid premature crystallization, and must be considered in the design of the die.

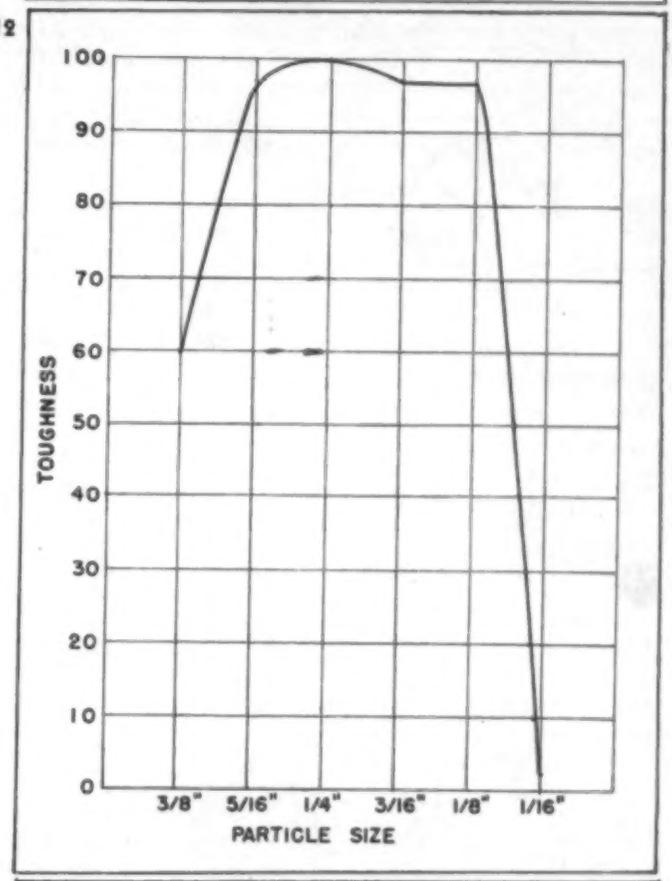
It has been pointed out that the cylinder temperature and the duration of the heating should not much exceed the minimum required for complete melting of the nylon. Automatic control of the cycle is recommended. The optimum temperature will depend upon the individual equipment. For one make of injection machine, equipped with a nozzle as herein described, the proper temperature of the material has been found to be 530° F.

Early attempts to mold nylon in conventional injection molding equipment failed because of excessive oozing of molten nylon from the nozzle. This prevented proper seating of the nozzle in the die bushing and proper closing of the die. It was realized that a shutoff nozzle would have to be developed to overcome this serious trouble. Fig. 13 shows a nozzle of the plug-cock type, actuated by contact switches and pneumatic cylinders. The advantage of less wear of moving parts was overbalanced, however, by the complexity of the cylinder set-up which precluded its commercial use. The second nozzle used is shown in Fig. 14. The small plug was held in closed position by the pressure of the piston, and pushed into open position by contact of the die bushing when the die was closed. This nozzle was unsatisfactory because excessive mechanical wear resulted from the repeated impact

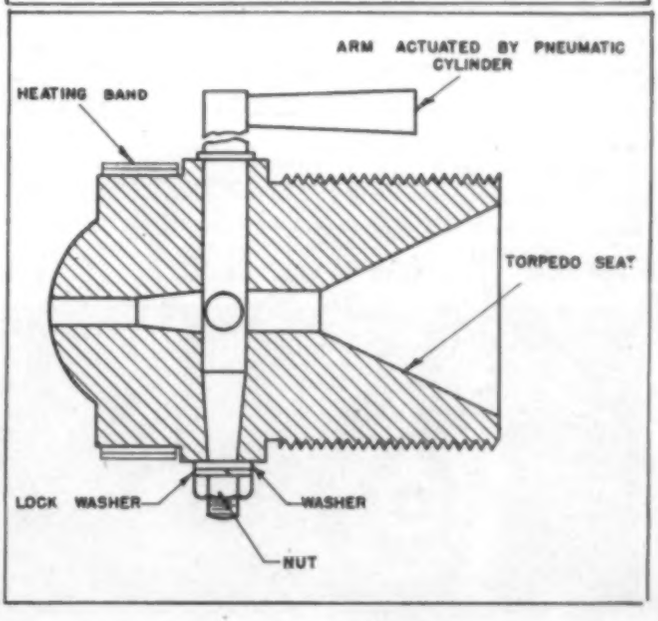
11



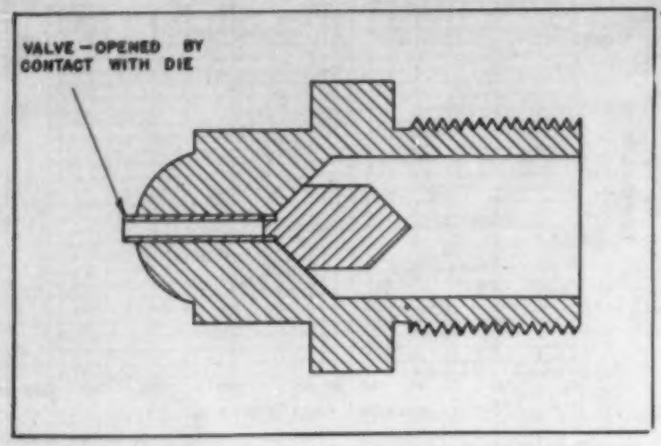
12



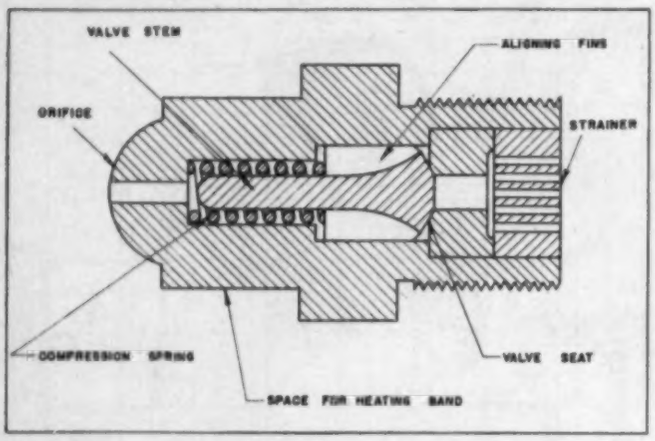
13



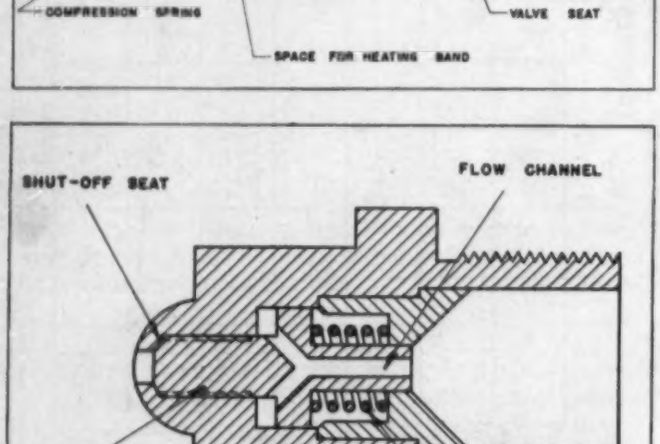
11—The heat-distortion temperature of FM-1 nylon vs. fiber stress is shown in chart. 12—This line drawing demonstrates the effect of the particle size on the toughness of the FM-1 nylon. 13—This nozzle of the plug-cock type, is actuated by contact switches and by pneumatic cylinders



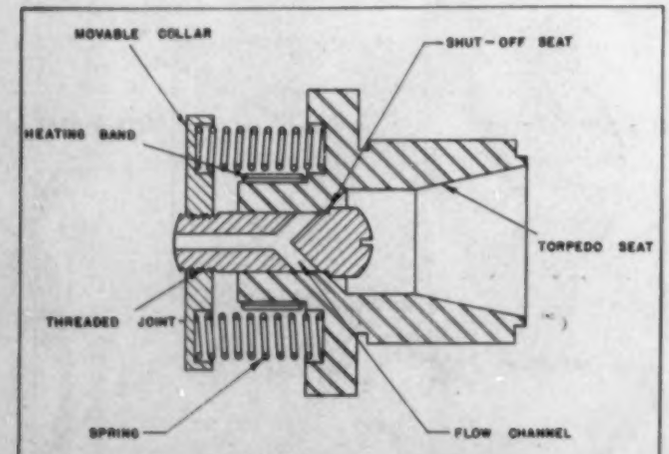
14



15



16



17

of the nozzle on the die bushing and because the shutoff was not reliable enough to permit of automatic operation of the equipment.

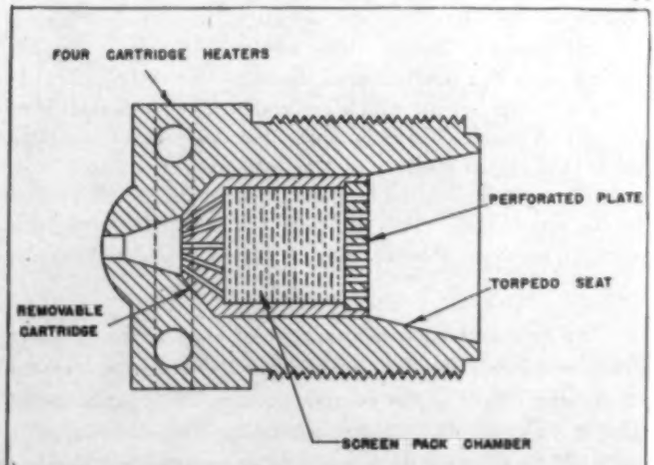
The nozzle shown in Fig. 15 works quite satisfactorily and allows automatic operation. Wear of the plunger and drawing of the temper of the spring necessitate occasional shutdowns for repairs. The nozzle shown in Fig. 16 was an improvement over the preceding type in providing a positive shutoff, and avoided the drawing of the temper of the spring. Of the nozzles with moving parts, this one was the best. The next nozzle, shown in Fig. 17, was a combination of the first 3 types. It embodied improvement resulting from the relocation of the springs which prevented any drawing of the temper, but did not work as an effective shutoff.

The type of nozzle finally adopted is illustrated in Fig. 18. This depends for shutoff entirely upon the restriction offered by a pack of screens of various sizes; it has the great advantage of freedom from moving parts and, therefore, freedom from wear. The system provides both an effective shutoff and a screen for the removal of unmelted particles. A series of cartridge heaters keeps the material molten in the front section. After continued operation the nozzle may readily be cleaned simply by removing the screen-pack compartment and replacing it with a new one.

An injection machine of the type which uses a vertical cylinder, when equipped with a standard sliding head, has been found to be satisfactory for molding nylon. The sliding head serves as an effective shutoff and is shown in Fig. 19.

Die design has been found to be of great importance in the injection molding of nylon. The molten character of the material when it enters the die allows it to penetrate around loose-fitting pins and out through any imperfection at the parting line of the die. For this reason dies must be very carefully made, knockout pins must fit closely and the mating surfaces must be ground to give perfect contact on the zone adjacent to the cavity. The fluidity of the molten nylon must be considered also in (*Please turn to page 166*)

14—*The plug in this second nozzle is held in closed position by the pressure of the piston and is pushed open by contact of the die bushing.* **15**—*This nozzle which allows automatic operation, works quite satisfactorily.* **16**—*Provision of a positive shutoff in this nozzle is an improvement over the preceding type.* **17**—*This nozzle is a combination of the first 3 types.* **18**—*Freedom from moving parts with a consequent freedom from wear is one of the principal advantages of this last type of nozzle*



18

Photoelastic detection of strains

by JOHN DELMONTE* and WM. DEWAR*

PHOTOELASTIC examination of injection-molded transparent plastics permits a qualitative evaluation of the effects of different molding conditions. Unlike the physically stressed prototypes, the general appearance of molded transparent plastics is far from an orderly array of stress lines, depicting as it does the heterogeneous flow patterns occasioned by discontinuities within the mold. However, there are certain recurrent flow patterns which arise and which permit some interpretation.

In order to reduce the number of variables, an injection mold for a radio push-button control panel was employed throughout the tests. The total weight of the molded part was 30 grams, based on a specific gravity of 1.27. All pieces were injection molded in a 4-oz. injection molding machine. The thickness averaged about 0.090 inch.

Representative transparent grades of injection molding compounds of cellulose acetate, cellulose acetate butyrate, cellulose acetate of high acetyl content, polystyrene and polymethyl methacrylate were examined. The cellulose plastics were of medium-soft flow variety (MS) unless indicated otherwise. Most of the results are based upon photoelastic examination of cellulose plastics, largely because these gave the most distinct stress patterns. After molding, all samples were stored under the prevailing room temperature conditions until ready for photographing.

The various transparent plastics, injection molded under the conditions described below, were mounted between two sheets of "Polaroid" film. A special green Wrattan light film passed a limited range of substantially monochromatic light, permitting the formation of dark and light regions, which otherwise would be ill-defined and difficult to photograph if the details were colored.

While the accompanying photographs may suggest by reason of their mottled, dirty appearance that the specimens were not clean or clear, in all cases when viewed by the naked eye in daylight they appeared clear and uniformly transparent. Any departures from this condition as indicated in the photographs is due to the internal stress as revealed by polarized light.

Test conditions examined

There are many variables which will affect the quality and the photoelastic appearance of an injection-molded transparent plastic. Among these are:

1. Injection molding temperature
2. Injection molding pressure
3. Speed of the injection ram
4. Temperature of injection mold
5. Time pressure is maintained on material after it enters the mold
6. Time the material is cooled
7. Moisture or impurities in molding material.

Of the above variables the first 3 were the most critically examined. Typical results are shown in Figs. 1, 2 and 3. Slow ram speed in these tests was 125 in. per min. and fast ram speed was 175 in. per minute.

In critically examining these photographs, the following procedure will facilitate observing and interpreting the various phenomena:

A. Locate the weld mark where the divided paths of the flow have recombined. Distinct weld marks in the photoelastic photograph, also accompanied by additional stress lines, are indicative of pronounced weld marks (an undesirable condition) and are usually visible in daylight to the naked eye.

B. Examine those regions where a uniform dark or uniform light color prevails. These are regions of constant stress and are a desired condition in injection-molded plastics.

C. Examine those regions characterized by alternate light and dark bands or lines. These regions indicate a stress gradient and represent the most likely spheres where dimensional instability may occur.

D. Examine stress lines at the corners passed by the molding material as it flows from one end of the mold to the other. These stress lines emphasize the desirability of well-rounded corners on molded plastics.

Discussion of photographs

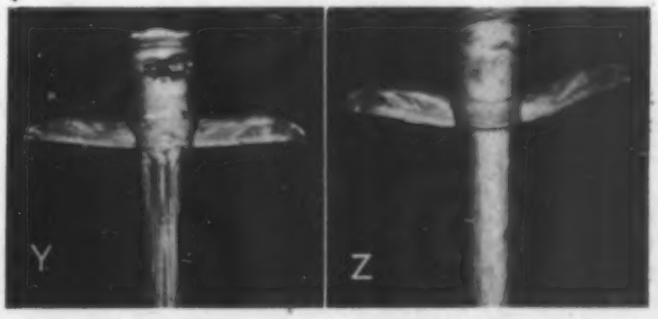
At the first glance there may not appear to be very much difference between the various photographs. However, with some study these "fingerprints" of injection-molded articles may suggest where faults or internal strains lie in certain molded pieces. An examination of these photographs and many more leads to a number of general observations:

In Fig. 2 observe the stress concentrations in the right-hand corners nearest the gate in A and B, more characteristic of high temperature moldings. Weld marks are very sharp at the lower molding temperatures in C and D. Also, observe the clearer pattern in the photoelastic photographs of transparent acrylic plastics in K and L. The absence of frequent stress lines does not mean that the acrylics are more free from strain than cellulose plastics, but rather that the acrylics are less optically sensitive to polarized light. This means that fewer light and dark bands will appear for a given stress gradient in acrylic plastics than in cellulose plastics.

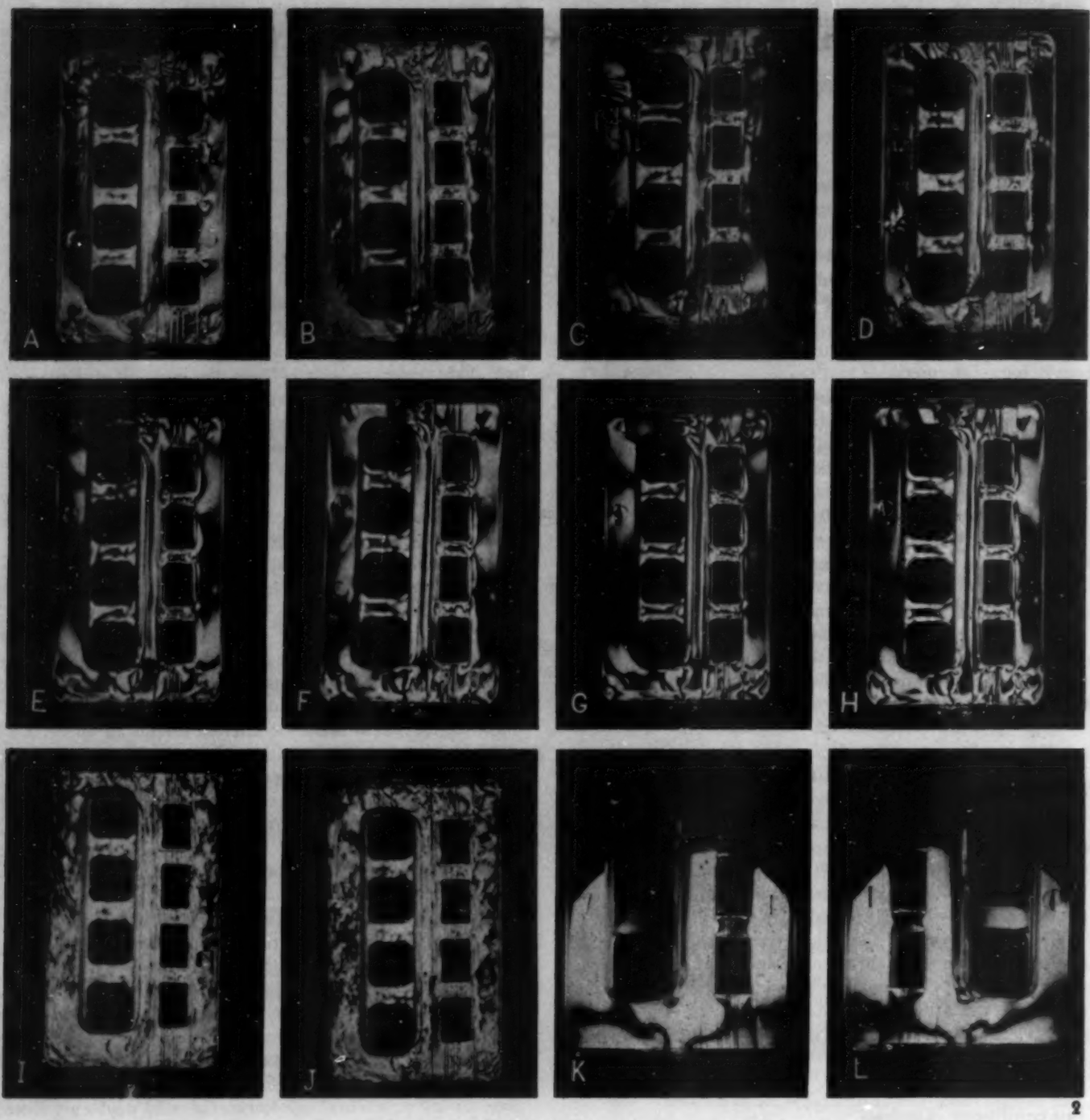
In Fig. 3, the greater concentration of stress lines in the high molding pressure specimen in M would suggest more dimensional instability. However, the weld marks are more pronounced at the lower pressures in N and O. The stress

1—Photoelastic examination of sprues of cellulose acetate molded at 380 to 390° F. Y shows stress lines developed at 6400 p.s.i. injection molding pressure, Z those developed at 16,000 p.s.i. injection molding pressure

1



* Plastics Industries Technical Institute.



2

LEGEND

Top row: cellulose acetate

A—380 to 390°F.; slow ram; 16,000 p.s.i.
B—380 to 390°F.; fast ram; 16,000 p.s.i.
C—335 to 350°F.; slow ram; 16,000 p.s.i.
D—335 to 350°F.; fast ram; 16,000 p.s.i.

Middle row: cellulose acetate butyrate

E—370 to 380°F.; slow ram; 16,000 p.s.i.
F—370 to 380°F.; fast ram; 16,000 p.s.i.
G—370 to 380°F.; slow ram; 9600 p.s.i.
H—370 to 380°F.; fast ram; 9600 p.s.i.

Bottom row: polystyrene (I and J); polymethyl methacrylate (K and L)

I—410 to 420°F.; fast ram; 9600 p.s.i.
J—410 to 420°F.; fast ram; 16,000 p.s.i.
K—410 to 420°F.; fast ram; 9600 p.s.i.
L—410 to 420°F.; fast ram; 6400 p.s.i.

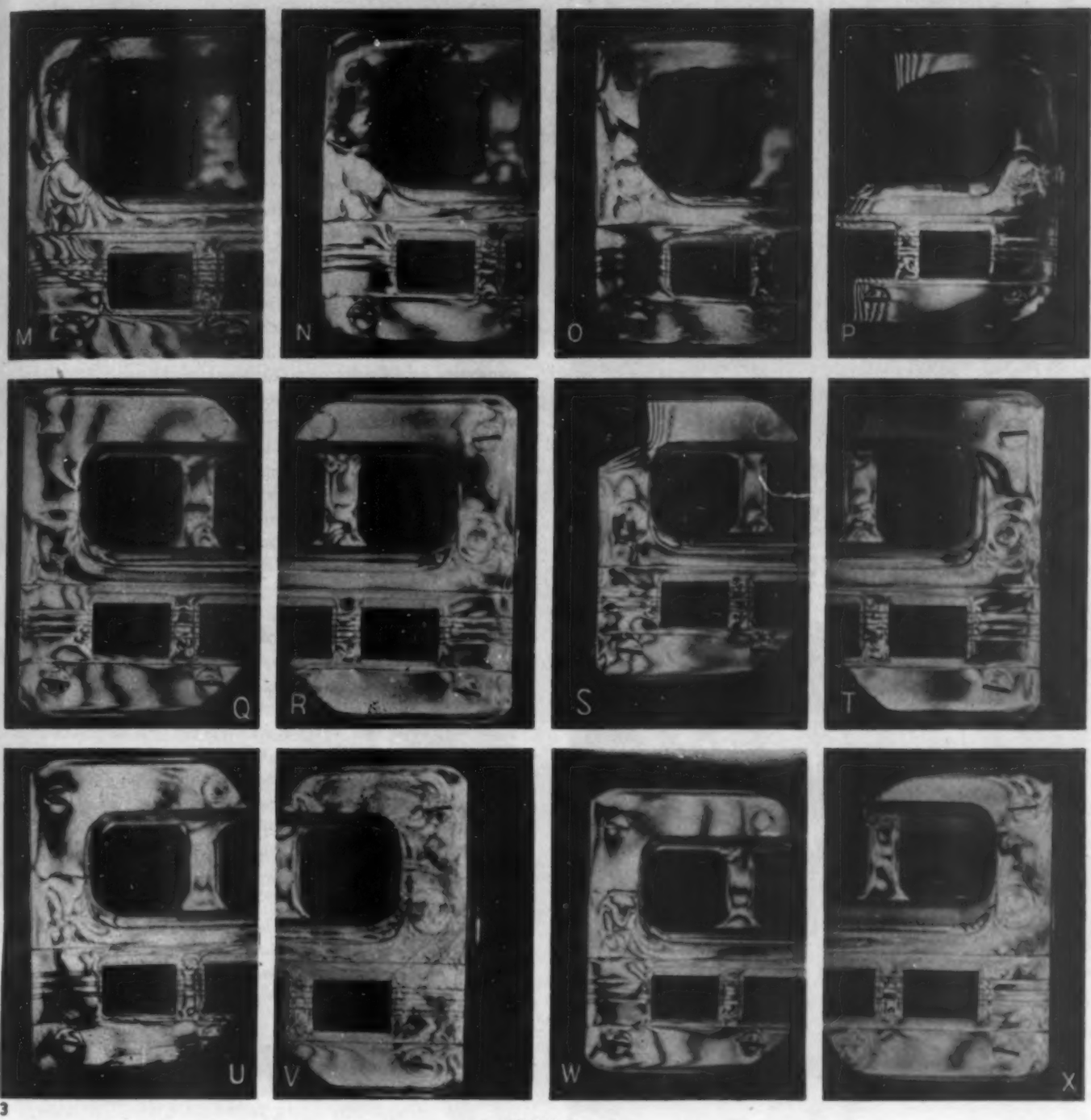
2—Photoelastic examination of injection-molded radio push button presents a disorderly array of stress lines

lines at the incompletely molded ends in P are evidence of the back pressure developed by the material (Flow MS) as it was chilling at a relatively low injection temperature. The specimens in the bottom row of Fig. 3 demonstrate the reasonable uniformity of stress patterns in a specimen from the first molding cycle (U and V) and a specimen from the fifth continuous molding cycle (W and X).

Particularly noteworthy in Fig. 1 are the pronounced stress lines developed at the lower injection pressure. This indicates that for the thermoplastic material shown, the stress gradient across the path of flow is much more apparent at the lower injection pressures.

Conclusions

1. Stress lines are more frequent and more pronounced in the vicinity of the weld mark at low molding temperatures



3

LEGEND

Top row: cellulose acetate	Middle row: cellulose acetate (high acetyl); fast ram	Bottom row: cellulose acetate (high acetyl); fast ram
M—380 to 390°F.; fast ram; 16,000 p.s.i.	Q—350 to 360°F.; 16,000 p.s.i.; weld end	U—390 to 400°F.; 16,000 p.s.i.; weld end, first cycle
N—380 to 390°F.; fast ram; 9600 p.s.i.	R—350 to 360°F.; 16,000 p.s.i.; gate end	V—390 to 400°F.; 16,000 p.s.i.; gate end; first cycle
O—380 to 390°F.; fast ram; 6400 p.s.i.	S—350 to 360°F.; 6400 p.s.i.; weld end	W—390 to 400°F.; 16,000 p.s.i.; weld end; fifth cycle
P—320 to 330°F.; fast ram; 16,000 p.s.i.	T—350 to 360°F.; 6400 p.s.i.; gate end	X—390 to 400°F.; 16,000 p.s.i.; gate end; fifth cycle

3—When viewed with the naked eye in daylight all these specimens appeared clear and uniformly transparent

than are the stress lines at high molding temperatures.

2. The weld mark for the specimen used in these tests was closer to the gate under the following conditions: a) low temperature, b) low injection pressure and c) slow ram speed. This would be expected because the weld mark in the current examination was formed from a path of flow directly off the gate and a second path of flow which had to make a sharp turn. Any of the conditions mentioned above would have the effect of moving weld mark up the latter path of flow.

3. Corners nearest the gate are more heavily stressed for high molding temperatures than they are for the low molding temperatures.

4. For minimum stress lines in the photoelastic patterns the following combinations appear best: a) low injection pressure, slow ram, high injection temperature; or b) high injection pressure, fast ram, low injection temperature.

Resin impregnation of wood[1]

by RALPH CASSELMAN[2]

THE story of resin impregnation is part of a larger story—that of the struggle to use to better advantage one of our most abundant and versatile raw materials—wood. Not many years ago wood technologists and chemists were strangers in most plants, not understood in others and frequently resented by the production-minded men whose only interest lay in making more of their standard type of production with faster equipment, or cutting the corners further to lower the cost per unit.

These days, however, the story is far different. So many upheavals have taken or are taking place in the wood industries that the total amounts to a mass movement having the momentum of a landslide. Of the many phases of this movement, one of the most important has comprised the association of wood with synthetic resins. We think there is no question that these resins have in many ways contributed greatly to the renaissance and the present recognition of wood as a modern material of many uses and a future material of many more. Resin adhesives for plywood and synthetic resin coatings are the two outstanding contributions. It may be that resin impregnation is another.

By impregnation with synthetic resins, we strive to overcome certain of the limitations of natural wood or to develop properties so different as to be considered new. The actual process of impregnation has been so frequently described that we need only outline the procedures in defining the two principal types of treated wood: impreg and compreg.

Impreg is made by impregnating wood, usually veneers with a synthetic resin solution, drying and then baking at 200–250° F. to set the resin. The treated veneers are usually bonded as with plywood or laminated wood. Impreg has a density fairly close to that of the original wood.

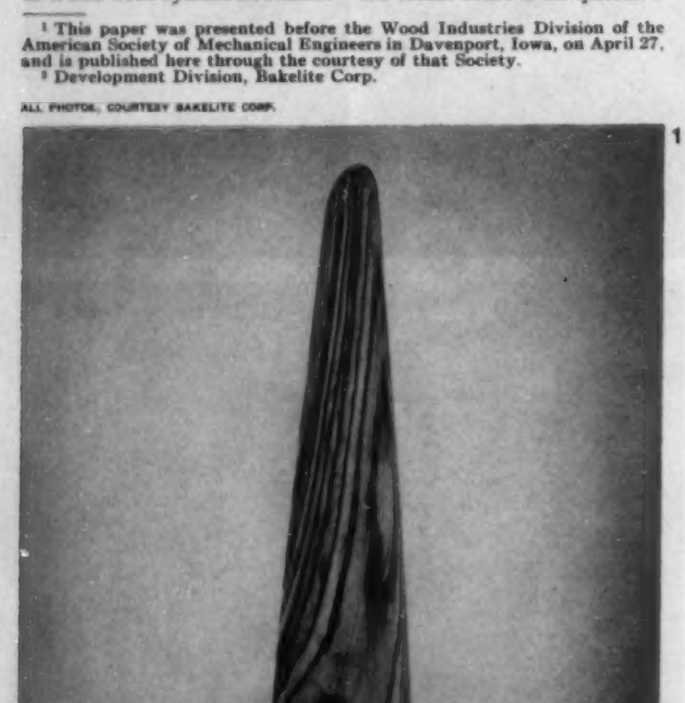
Compreg is made by impregnating, drying, then densifying under heat and pressure with steam platens; pressures run from 900 to 2800 p.s.i., temperature, 260–320° F. and press times, 20 to 100 minutes. Nominally anything compressed to appreciably less than its original thickness has been "compregnated" but the product of greatest current interest has a specific gravity of 1.3 to 1.4, which is fairly close to the maximum obtainable with wood and resin.

When the density is increased in going from impreg to compreg, the mechanical properties change about in proportion. A good summary of these properties is given in Table I for Jabroc laminated densified wood made in England.

[1] This paper was presented before the Wood Industries Division of the American Society of Mechanical Engineers in Davenport, Iowa, on April 27, and is published here through the courtesy of that Society.

[2] Development Division, Bakelite Corp.

ALL PHOTOS, COURTESY BAKELITE CORP.



1

TABLE I.—PROPERTIES OF JABROC LAMINATED DENSIFIED WOOD[a]

Specific gravity	*Tensile strength p.s.i.*	*Compressive strength p.s.i.*	*Modulus of elasticity p.s.i.*	*Shear strength ⊥ to grain p.s.i.*
.8	20,000	..	..	..
.9	23,000	14,500	2,800,000	4700
1.0	25,500	16,500	3,100,000	5250
1.1	28,000	18,000	3,350,000	5750
1.2	30,000	19,500	3,500,000	5300
1.3	32,000	21,000	3,700,000	6800
1.4	34,000	22,500	3,850,000	7350

[a] These data have been taken from the article "Resin Laminated Densified Wood" by A. E. L. Jervis, Plastics 7, 122–127 (Mar. 1943).

Other types of densified wood are made—one, for instance, made by bonding veneers with phenol resin film under high pressure virtually without impregnation, another by bonding with thermoplastic resins and compressing both vertically and sideways—but in each case no real impregnation takes place.

Contributions of resin to wood properties

In both compreg and impreg, wood is the backbone of the products; wood does the work. But the synthetic resin is a

1—This zebra-hued propeller blade for a fighting plane is made from resin-impregnated wood laminations which are compressed into boards and bonded into a solid block

valuable accessory and helps to improve the qualities or working properties in which the wood by itself is deficient. Here is a brief résumé of what the resin does for the wood:

First—It plasticizes or softens the wood so that it can be compressed to high densities with reasonable pressure and moisture content. The effect is illustrated by the pressing of two panels of oven-dried birch of 16 plies of 0.05 in. thickness, total 0.80 inch. After pressing at 1000 p.s.i., the untreated panel remained at 0.79 in. thickness, density 0.76. The resin-impregnated veneers, however, compressed to 0.52 in. with a density of 1.34.

Second—The resin holds the plies of veneers together. Since it has been found advisable to treat the wood in the form of veneers, a good durable adhesive is necessary to avoid delamination. Sometimes the impregnating resin serves as the adhesive in addition to its other functions; in other cases a separate coating of special adhesive is applied to the veneers to obtain adequate bonding. In some types of compreg, the resin is primarily the adhesive and impregnates only slightly.

In principle, we are inclined to favor the separate adhesive in addition to the impregnant since the full bond is vitally important to the performance of the section and the added operation is probably worth while as an insurance. A heavy section such as a propeller may include more than a hundred glue lines, of which one failing may ruin the blade.

Third—The resin bonds the fibers, fixing them in their compressed state and holds them firmly in place, fortifying them against tendency to spring back on release of platen pressure or when subjected to the action of moisture. At first glance, this bonding effect might be expected to result in higher cross-grain tensile strength and shear strength parallel to the grain, but the data are disappointing in that the values run only about in proportion to the density.

Fourth—The presence of the resin interferes with the *rate* of moisture absorption and penetration. The effect is probably due to several factors: resin closes the open paths or channels through which moisture might pass. It may react with the wood constituents to produce a material less permeable to moisture. Densification also tends to reduce permeability. The effect of the resin in reducing penetration even in non-densified wood is surprisingly great, especially when it is considered that a continuous film is not observable. Stamm and Seborg reported that treatment with 20 percent water-solution resin reduced moisture vapor transmission 90 percent compared to an untreated panel—better than most coatings.

Fifth—The resin should have a real effect on the *ultimate* properties of the wood. Note that in this respect certain phenol resins at least differ markedly from waxes, oils, natural resins, urea resins and other impregnants, which only retard the *rate* of moisture absorption. These special phenol resins are capable of stabilizing the dimensions of wood so that swelling, shrinking and checking are materially reduced. This ability to stabilize is called the anti-shrink efficiency and can easily reach 65 percent with one treatment or 90 percent with several treatments. For a simple example, wood having a wet or green width of 11 in. and a dry width of 10 in. could by resin treatment be stabilized at 10.65 in. dry and 11 in. wet. The resin can be important where dimensions should be held closely throughout varying conditions of humidity.

The stabilizing phenol resins also displace the equilibrium moisture content at given relative humidities. Our data show that birch having an equilibrium moisture content of 8 percent will carry only about 4 percent when treated with 30 percent of proper stabilizing resin. This effect may be of some benefit in minimizing weight changes with increased humidity but unfortunately the control is gained only at the expense of an original weight penalty of about 20 per cent. The weight penalty is not equal to the total resin content since the volume is increased about 10 percent by the treatment.

2—*This cube was cut from a solid block of resin-impregnated wood laminations used in making a propeller*

A further and important beneficial effect of the stability treatment is the better maintenance of mechanical properties when the wood is wet or higher in moisture content. The natural wood loses strength rapidly with increase in moisture. Birch, for example, with a nominal compressive strength of 12,800 p.s.i. at 3 percent moisture content drops to half or 6400 p.s.i. at 16 percent moisture content. Table II presents data regarding the effect of resin impregnation on wet and dry flexural strength of wood.

TABLE II.—WET AND DRY FLEXURAL STRENGTH OF RESIN-IMPREGNATED PLYWOOD, NOT DENSIFIED, BONDED WITH BAKELITE RESIN XC-16168

	Construction	*Dry flexural strength p.s.i.*	*Wet flexural strength[a] p.s.i.*
1.	3-Ply 1/16-in. fir, alternate cross-grain, all plies untreated	8600	4320
2.	5-Ply 1/16-in. fir, alternate cross-grain, all plies contain 25 percent BR-16442 precured	9000	6630
3.	5-Ply poplar, 1/20-in. faces, 1/8-in. core and cross-band, all untreated	..	3940
4.	5-Ply poplar, 1/20-in. faces, 1/8-in. core and cross-band, faces contain 35 percent BR-16442 precured	..	4820

[a] Wet strength taken on 1/2 × 1/2 × 9 in. samples boiled 10 min., soaked 1/2 hr. in cold water.

Sixth—The resin increases the hardness of the wood and to some extent the compressive strength.

Seventh—Usually the impregnation tends to embrittle the wood, in extreme cases causing a loss of 90 per cent of the notched Izod impact strength. In a general way, the more thorough the impregnation, the greater the effect on the impact resistance. (*Please turn to next page*)

PHOTO, COURTESY FORMICA INSULATION CO.

3—*A daily shipment of blocks ready to send to the fabricator to be machined into finished airplane propellers*

Eighth—The impregnating resins markedly improve the wood's resistance to decay and attack by termites.

Ninth—The phenol resins, at least, increase the wood's resistance to acids.

Types of resins in compreg and impreg

A number of synthetic resins have been proposed as impregnants for wood but to date phenol resins have apparently not been equalled on an over-all basis. Exceptions should be noted, including melamine and polyvinyl butyral resins for certain special applications, but by far the greater bulk of compreg and impreg is made with phenol resins.

In the phenol resins alone, however, there are many variations recommended for wood impregnation ranging from the low molecular weight, water-soluble, extremely penetrating resin on the one hand to the heavily bodied, almost non-penetrating, bonding resins on the other. A distinction is frequently made between the so-called "alcohol soluble" and "water soluble" but this distinction is unfortunately not accurate. The water-soluble resins are also alcohol soluble and the alcohol-soluble resins can be rendered water soluble. Also some water-soluble resins impart to the compreg the properties usually associated with the spirit-soluble resins. A better distinction might be to call them low or medium molecular weight resins—the low range being 150–200, the medium range 500–1000.

TABLE III.—PROPERTIES OF BIRCH COMPREG MADE WITH VARIOUS RESINS[a]

Property	*Birch impregnated with 34.5% resin XJ-16235*	*Birch impregnated with 30% resin BR-15100*	*Birch impregnated with 30% resin BV-10678*
Specific gravity	1.32–1.37	1.35–1.37	1.34
Modulus of rupture, p.s.i.	38,000–40,000	37,000–42,000	40,000
Modulus of e'asticity in bending, p.s.i.	3.45×10^6	$3.0–3.6 \times 10^6$	3.5×10^6
Impact strength, Izod, ft.-lb./-in. of notch	7.3	1.4–4.1	6–7.0
Compressive strength, p.s.i.	25,000	25,000	25,000
Shear strength, perpendicular to lamination and parallel to grain, p.s.i.	6000–7000+	6000–7000+	6000–7000+
Water absorption[b]	2.3	1–2	4–6

[a] BR-15100 is a low molecular weight, water-soluble, penetrating and stabilizing phenol resin; XJ-16235 is a plasticized version of BR-15100; BV-10678 is in alcohol solution of a medium molecular weight phenol resin.

[b] Test specimen 1 × 3 × 1/4 in. crossgrain; dried 24 hr. at 50° C., weighed, soaked 24 hr. in water at 25° C., and re-weighed.

The data in Table III pertain to compreg made in standard procedures to develop balanced properties. If special properties are desired, they can usually be obtained in one way or another, sometimes at the sacrifice of other properties or by the use of special techniques. By special treating methods, for example, we have obtained compreg containing 40 percent resin having an impact strength of 14 ft.-lb./in. of notch, which is just about the ultimate for densified birch without any resin. We have obtained a density of 1.43, water absorption as low as 0.8 percent, modulus of rupture up to 55,000 p.s.i., modulus of elasticity in bending up to 5,000,000 p.s.i. The shear strength values can be adjusted over a wide range by cross-plying the veneers or placing them at a slight angle, by densifying from the sides as well as the top and bottom, or by introducing a wave in the plies of the veneer.

It is obvious that with many of the variables subject to control, compreg is a custom-built material. Since the suitability is not always described by numerically definable properties, any proposed application should involve not only an estimate of the properties required and the cost allowable, but actual trial under the most severe conditions likely to be encountered in service.

Sometimes we like to look forward to what may eventually be available in materials. As a guess, probably rash, on some of the properties that can eventually be expected, we can list the following:

Specific gravity	1.4
Modulus of rupture, p.s.i.	48,000
Modulus of elasticity in bending, p.s.i.	5,000,000
Impact strength, Izod, ft. lb./in. of notch	12
Compressive strength, p.s.i.	28,000
Shear strength, parallel to grain and perpendicular to lamination, p.s.i.	8,000
Shear strength, parallel to grain and lamination, p.s.i.	6,500
Shear strength, perpendicular to grain, p.s.i.	16,000
Water absorption, 24 hr. percent	0.8

These seem to be fair limits obtainable in a single parallel-grain material with practical equipment and procedures.

Applications of compreg and impreg

Many proposed applications for compreg have been listed but by far the most important present use of compreg is in propeller blades for aircraft. The English have long used several types of resin-treated or resin-bonded and densified wood blades and the compreg blade is now in successful production and use in this country. Test clubs have been molded for some time utilizing a process in which the blank is preheated by high frequency, then molded and densified in a heated press.

Ventilating fans appear to be a legitimate field for treated wood because of its mechanical properties and resistance to corrosive atmospheres. For many years electrical insulating parts requiring high strength and shock resistance have been made of resin-impregnated and densified wood. Compreg is also used to take the concentrated (*Please turn to page 168*)

SPIRIT OF '43

FIFES of extruded Tenite tubing, used by U. S. Army fife-and-drum corps, have more tone penetration and wider octave range than standard metal fifes. They require no polishing to preserve their finish, will not freeze to the player's lips in arctic weather, or become unbearably hot under tropic sun. Tenite fifes are rapidly produced by sawing and drilling the tubing, and inserting a plug in one end.

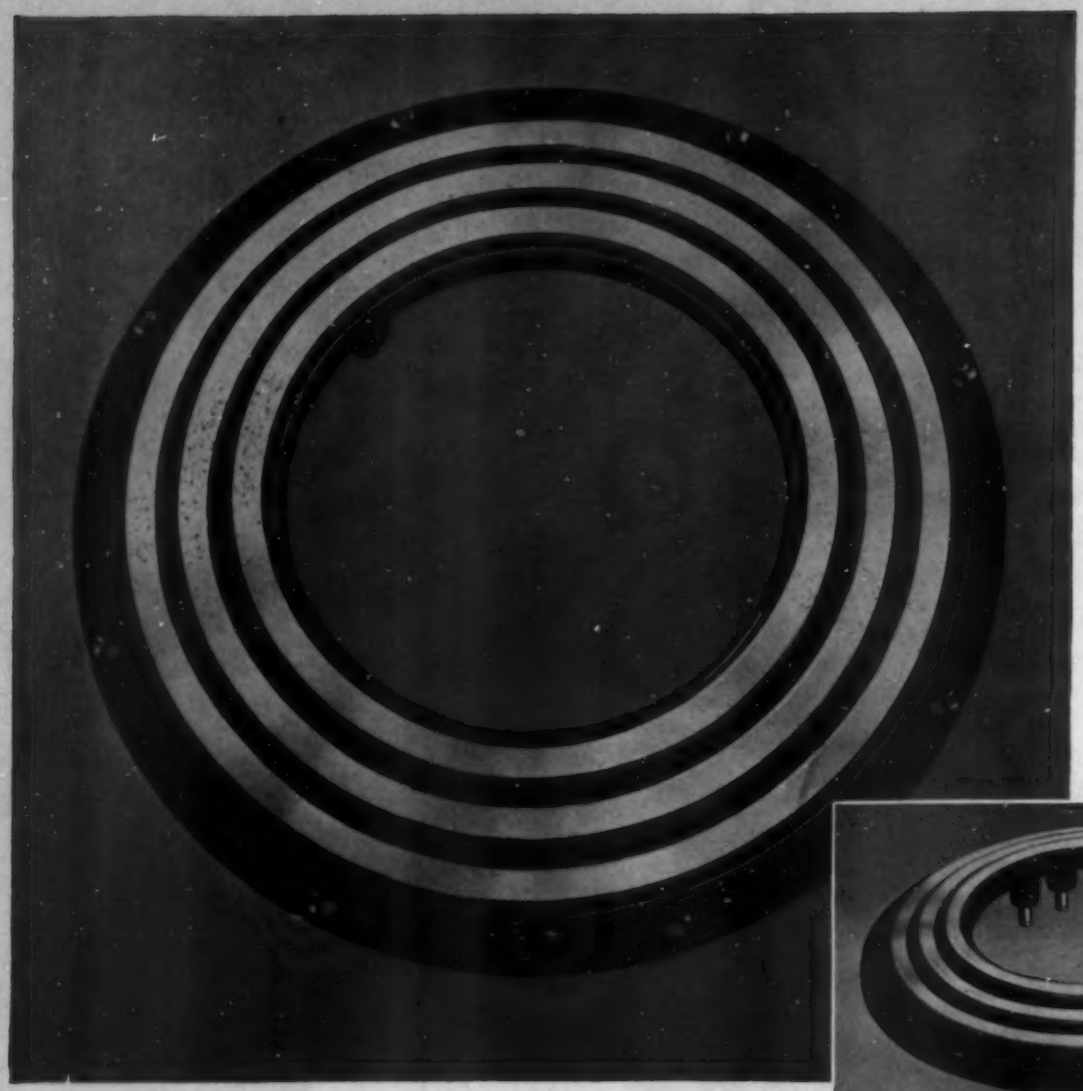
Tenite is molded and fabricated into many other warfare products, which include bugles, bayonet scabbards, ammunition rollers, and snake-bite kits. The use and distribution of Tenite are at present controlled by General Preference Order M-154 and Supplementary Allocation Order M-326-a. TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENNESSEE.

• • • •

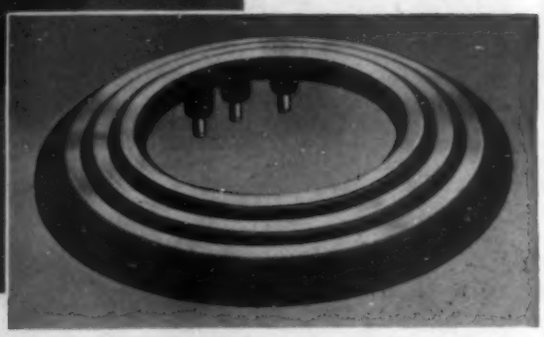
TENITE REPRESENTATIVES: *New York,* 10 East 40th Street. *Buffalo,* 1508 Rand Building. *Chicago,* 1564 Builders' Building. *Dayton, Ohio,* 305 Third National Building. *Detroit,* 904-5 Stephenson Bldg. *Leominster, Massachusetts,* 39 Main St. *Washington, D. C.,* 1125 Earle Bldg. . . . *Pacific Coast:* Wilson & Geo. Meyer & Company—*San Francisco,* 15th Floor, 333 Montgomery St., *Los Angeles,* 2461 Hunter St., *Seattle,* 1020 4th Ave., South.

Tubing by Extruded Plastics, Inc.
Fifes by Penzel, Mueller & Co., Inc.

TENITE *an Eastman Plastic*



THE SYMBOL OF
ENGINEERING EXPERIENCE
AND MOLDING SKILL



FUNCTIONAL DESIGN in PLASTICS

This rotor for the transmission of electric power is made in one piece by transfer-molding. Its bi-metal rings are set in permanent alignment. The molded assembly was designed by us in close cooperation with engineers in the aircraft industry. The single piece construction met precise requirements that were unattainable through previous manufacturing methods.

PLASTICS ENGINEERING MADE THESE IMPROVEMENTS

- ... assembly and service problems eliminated through molded one-piece construction.
- ... contact posts remain aligned with mounting screws.
- ... balanced physical and electrical properties secured through our selection of molding material.
- ... higher resistance to moisture, with consequent reduction in power loss.
- ... improved contact and corrosion resistance obtained through bi-metal rings of copper alloy with silver finish.

PLASTIC MANUFACTURERS

INCORPORATED

INJECTION AND TRANSFER MOLDING

STAMFORD, CONNECTICUT

SOMEONE HAS TO BE FIRST IN A PARADE . . .

. . . and it's just as true in the plastics extruding field

● Someone had to be first — in this case, the first commercial practitioner of dry plastics extruding was MACOID

● We were the first to make extruding applications in the automotive field. Furniture and refrigeration owed their original use of extruded plastics to MACOID Later our machines and methods were copied. But still the *new* applications came from MACOID During the war we have continued to pioneer new applications of the extruding process.

● We are extruding rigid and flexible materials in solid and hollow shapes for many branches of the Army, meeting low-temperature flexibility and high-temperature stability requirements. MACOID *still leads the extruded plastics parade.*

We also do injection molding

DETROIT MACOID

CORPORATION

12340 Cloverdale Ave. Detroit, Michigan

ORIGINATORS OF DRY PROCESS PLASTIC EXTRUSION

TECHNICAL BRIEFS

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments

Engineering

LAMINATING BY LOW-PRESSURE METHOD. J. D. Nelson. Gen. Elec. Review *46*, 483–7 (Sept. 1943). Graphs are presented which show the variation of tensile, flexural and compressive strengths, and moisture absorption of cotton cloth bonded at laminating pressures of less than 50 to 1000 p.s.i. At a resin content of 59 to 62 percent the flexural strength reached a maximum at 650 p.s.i. for a liquid phenolic, at 950 p.s.i. for a molding phenolic and at 700 p.s.i. for a modified amino resin. Two-thirds of the maximum flexural strength of the liquid phenolic is obtained at 100 p.s.i. while only $^1/_4$ to $^1/_3$ is obtained at 100 p.s.i. for the other resins. The laminates made from the liquid resin also were superior in tensile and compressive strengths and in moisture absorption. A resin content of 52 to 55 percent, bonded at 100 to 300 p.s.i. would give about the maximum mechanical and physical properties without resorting to high pressure molding. At the present limits of 65 to 75 p.s.i., the effective utilization of potential strength is quite high particularly for the liquid phenolic resin. The use of the aminoplast resin can be justified only where a lower curing temperature is imperative and where the lower strength and lower moisture resistance are acceptable. A comparison of grade C high-pressure phenolic laminate with various laminates bonded with the liquid phenolic resin at 65 p.s.i. shows that the cotton cloth low-pressure laminate is slightly inferior in tensile, flexural and compressive strengths, tensile modulus and moisture absorption, and that the kraft paper, the 100 percent rag paper and the glass cloth, cotton fill, low-pressure laminates are superior in these properties. The glass cloth is difficult to handle. The low-pressure laminates compare favorably mechanically with high-pressure laminates and possess the additional advantage of utilization in complex shapes without rupture of the fibers.

MOLDED PLYWOOD AIRCRAFT. G. L. White. Canadian Chem. *27*, 441–3 (Aug. 1943). The manufacturing procedures used in Canada to make the Anson Trainer Bomber, a molded plywood airplane, are described. Urea-formaldehyde resin glues are used for this purpose. The wooden surfaces are covered with dope and fabric.

INTRODUCTION TO THE THEORY OF PHOTOELASTICITY AND ITS APPLICATION TO PROBLEMS OF STRESS ANALYSIS. R. E. Arthur. J. Royal Aeronautical Soc. *47*, 263–72 (Aug. 1943). An elementary explanation of the theory of photoelasticity for those unfamiliar with the subject.

Chemistry

END GROUP STRUCTURE OF POLYVINYL ALCOHOL. C. S. Marvel and G. E. Inskeep. J. Amer. Chem. Soc. *65*, 1710–14 (Sept. 1943). During the hydrolysis of polyvinyl acetate and also during reesterification of polyvinyl alcohol, unexpected and irregular changes in the apparent molecular weight of the polymer have been noted. A possible explanation of this behavior is that polyvinyl alcohol may have one terminal aldehyde group which, under acid conditions, can undergo acetal formation with the hydroxyl groups of neighboring molecules. Under alkaline conditions an aldol or reverse aldol reaction may occur to cause changes in molecular size.

RESINOUS CONDENSATION PRODUCTS OF *p*-CRESOL WITH FORMALDEHYDE. A. A. Vansheldt, A. T. Itenberg and V. Mikhallova. J. Gen. Chem. (U.S.S.R.) *12*, 489–98 (1942). Molten *p*-cresol was mixed with paraformaldehyde and hydrochloric acid (1 percent of the cresol) and refluxed on a water bath. Free aldehyde was present after 180 hr. of reflexing. Ratios of 1.1 to 10 mols of cresol to 1 mol of aldehyde yielded resins soluble in benzene, acetone and alkali solutions. The resins were attacked but were not readily soluble in gasoline and ethyl alcohol. The thermoplasticity or solubility of the resins was not affected by heating for 10 hr. at 130° C. The molecular weight of the resins varied from 240 to 660 as the molal ratio of cresol to aldehyde was varied from 10 to 1.1. The resins are mixtures of materials of various molecular weights; they can be separated by fractional precipitation. The resins have a meso-methylene-poly-*p*-cresol structure with $n + 1$ cresol units connected through the aromatic rings by n methylene bridges. In every case one molecule of formaldehyde binds one and two molecules of cresol. The aldehyde is reacted completely only in the presence of a large excess of cresol at 100° C.

Properties

CREEP IN AIRCRAFT PLYWOOD. J. Delmonte and E. Watkins. Aero Digest *43*, 306–7, 365 (July 1943). Data are presented showing the creep of 3-ply birch and mahogany plywoods when loaded as cantilever beams. The effect of moisture gradient as a factor in distortion of plywood is also considered.

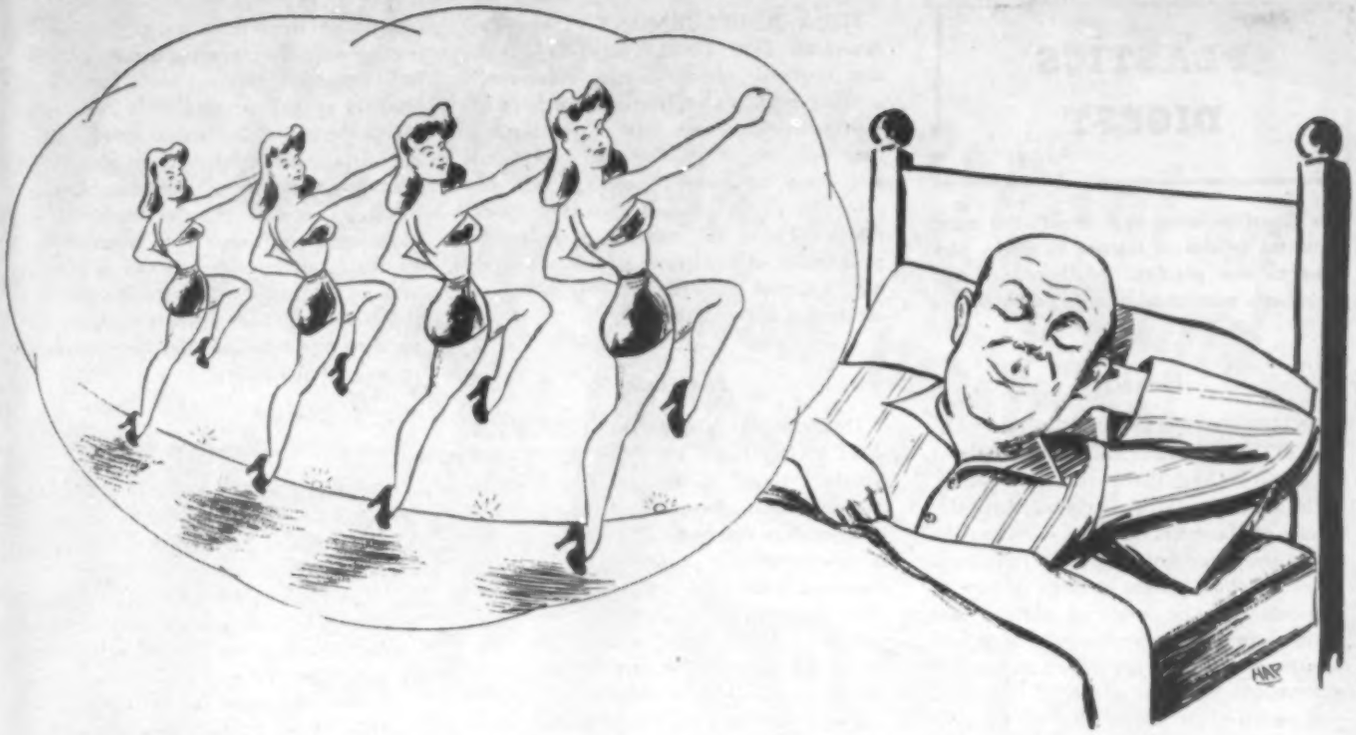
TECHNOLOGY OF SYNTHETIC RESINS. K. Grossmann. Z. wirt. Fertigung *45*, No. 10, 7–11 (1941). Tensile and compressive properties of filled phenolic and urea resins reach their maxima and water absorption a minima when the materials are molded at 200 atmospheres pressure (2940 p.s.i.). Plywood need not contain more than 7 to 8 percent resin, cellulose filled material not more than 25 to 35 percent resin and fabric laminates not more than 30 to 40 percent resin. The materials should be aged 10 hr. after molding before they are used. Holes shrank 5 percent in diameter during the first 10 hours.

DETERMINATION OF FREE FORMALDEHYDE AND AMMONIA IN PARTS MOLDED FROM UREA AND MELAMINE CONDENSATION PRODUCTS. A. Gaertner. Kunststoff-Tech. u. Kunststoff-Anwend. *11*, 272–8 (1941). Since formaldehyde and thiourea interfere with the test for ammonia, a new procedure was developed. The formaldehyde is first precipitated with dimedon, then the material is treated with sodium hydroxide and distilled in vacuo. The ammonia is collected in hydrochloric acid, treated again with alkali and distilled at atmospheric pressure. The ammonia is then determined with Nessler's reagent.

Testing

BEND-BRITTLE AND SHATTER POINTS OF RUBBERLIKE MATERIALS. G. E. King. Ind. Eng. Chem. *35*, 949–51 (Sept. 1943). Many rubberlike materials possess 2 relative points of change in physical properties corresponding to the bend-brittle temperature and the shatter point. Since the bend-brittle point varies and approaches the shatter point, the shatter point seems to be the true brittle temperature. These points change although they hold their relative positions in respect to each other for various plasticizers and for time of freezing. The 2 points approach each other as hardness increases through loading. Although there is a minimum distance from which a weight must be dropped to shatter a given sample, a greater distance does not raise the shatter point. The shatter and bend-brittle temperatures of several synthetic elastomers are reported.

BULLET "FOOTPRINTS" IN LACQUER AID SEARCH FOR BETTER WEAPONS. Metal Finishing *41*, 539 (Aug. 1943). The appearance of fine, closely spaced cracks in a lacquer coating on stressed metal parts is used to show the strain pattern in the part. To obtain quantitative information, the coating is applied to a standard steel bar which is bent under known loads as a cantilever beam. The cracks on the standard steel bar are then compared with those on the part under test.



Some people like to count sheep when they're suffering from insomnia. Others like to count chorus girls, or perhaps add up their income tax for 1943.

We're different. The thing that fascinates us most is plastics and the post-war.

Lying there in the still hours, we think: will plastics be around? *Our answer is yes.* We think: will plastics be cheaper? *Our answer is pretty positive.*

We think: will plastics be better? *We can only say we're going to try to make them so.*

We try to remember all the new things we've learned about plastics by making them for the Army and Navy. We try to visualize our plant (which is already larger than anything we've ever wanted) as it will look after the war. . .

Frankly, all of this is pretty heady stuff. It doesn't soothe us. It wakes us up and we usually don't get to sleep at all. But then, who wants to sleep?

Would you like to help us dream?

"A Ready Reference for Plastics" written for the layman, is now in a new edition. If you are a user or a potential user of molded plastics, write us on your letterhead for a copy of this plain non-technical explanation of their uses and characteristics. Free to business firms and government services.

BMCB

ARMY E NAVY

BOONTON MOLDING COMPANY

MOLDERS OF PLASTICS · PHENOLICS · UREAS · THERMO PLASTICS

BOONTON · NEW JERSEY · Tel. Boonton 8-2020

NEW YORK OFFICE

Chanin Bldg., 122 East 42nd Street, New York 17, N. Y., MUrray Hill 6-8540

PLASTICS DIGEST

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals mentioned directly to publishers

General

ENGINEERING ASPECTS OF PLASTICS. Henry Sang. Aero Digest *43*, 163–5+ (Aug. 1943). This is a survey of the status of plastics in the aircraft field. Choice of plastics is based on conservation of critical material, superior functional characteristics, weight savings or ease of fabrication. The kinds of plastics and their properties are reviewed. Trends in plastics engineering are linked to new developments in resins and reinforcements, and design of structures in which smooth, regular stress-flow is assured by variable thickness and density. Construction of airplanes a few years hence is visualized by a process of molding at contact pressure from a strong tough resin enclosing microscopically fine glass or synthetic filaments.

PLASTIC BODYWORK. W. Nichols. Automobile Eng. *33*, 361–5 (Sept. 1943). The properties of the various plastics are surveyed and discussed from the viewpoint of bodies for motor cars. It is concluded that this application appears promising only with the use of laminates. The standard fabric, paper and wood veneer materials are in this group. A new laminate consisting of cloth made from fiber and wire, and bonded with a phenolic-type resin, offers distinct possibilities for the construction of automobile bodies. Plywood also is considered as a possible material for this part.

PLASTICS AND THE OPTICAL INDUSTRY. W. G. Wearmouth. Proc. Physical Society *55*, 301–13 (July 1943). The refractive indices for the range 4000 to 7000 A. for a cast phenolic resin, 2 polystyrenes, methyl isopropenyl ketone resin, cellulose nitrate, cellulose acetate and 2 polymethacrylates are given in graphical form. Water immersion has no effect on the refractive indices of polystyrene and polymethyl methacrylate but those of cellulose acetate, cast phenolic resin and cellulose nitrate are markedly changed. Methyl methacrylate resin lenses can be surface hardened by placing them in a chamber which is evacuated and the vapors from a heated bath of silica or glass allowed to impinge on the surface of the lens. The vapors condense to give a hard, permanent, glass-like coating on the lens.

MICA REPLACEMENT. Scientific American *169*, 11–12 (July 1943). A new synthetic plastic called "Polectron" is being used as a replacement for mica in electronic apparatus. It is estimated that one ton of "Polectron" fabricated into mica replacement material will replace 10 to 15 tons of imported block mica. "Polectron" can be used in the production of electronic apparatus without material changes in equipment or method of manufacture.

Materials

IMPROVED FORMULATIONS WILL EXPAND POSTWAR USES OF NYLON Product Eng. *14*, 599–600 (Sept. 1943). Nylon plastic does not soften until the temperature reaches 450° F., is tough, has a specific gravity of 1.06 to 1.19, is slow burning, has good resistance to aging, sunlight, oils, grease, solvents, acids and alkalis, is easily molded and has good electrical properties. The first strictly plastic application was in bearings which require no lubricant for a light load at high speed or a heavy load at low speed. Films, coated fabrics and strips are proposed for use in furniture, shoes, handbags, luggage and carburetor diaphragms. Zippers, insect screening, tire cords, surgical sutures, rope, brush bristles, parachute cloth, and tubing have been made from nylon.

SYNTHETIC RUBBER CEMENTS. D. V. Sarbach. India Rubber World *108*, 249–52, 261; 363–67 (June, July 1943). Hycar OR-15 has been found to be one of the most useful and versatile of the synthetic rubbers for use in cement and adhesion work. The principles of processing necessary to satisfactory manufacture of cements and solvents for Hycar OR-15 are discussed. A brief outline for compounding the cements and 7 typical formulations are given.

Applications

AN AIRCRAFT DOUBLE WINDSHIELD. R. L. McBrien. S. A. E. Journal *51*, 350–5 (Oct. 1943). The development, advantages and disadvantages of the aircraft double windshield are discussed. Tests and experience show that the optical characteristics of the double windshield are somewhat inferior to those of a single pane windshield, but that this is more than offset by the improved ice protection and by increased strength to resist bird-strike. Adequate heating can be supplied from the cabin heating system to prevent ice from forming on the windshield in all except the most severe conditions encountered.

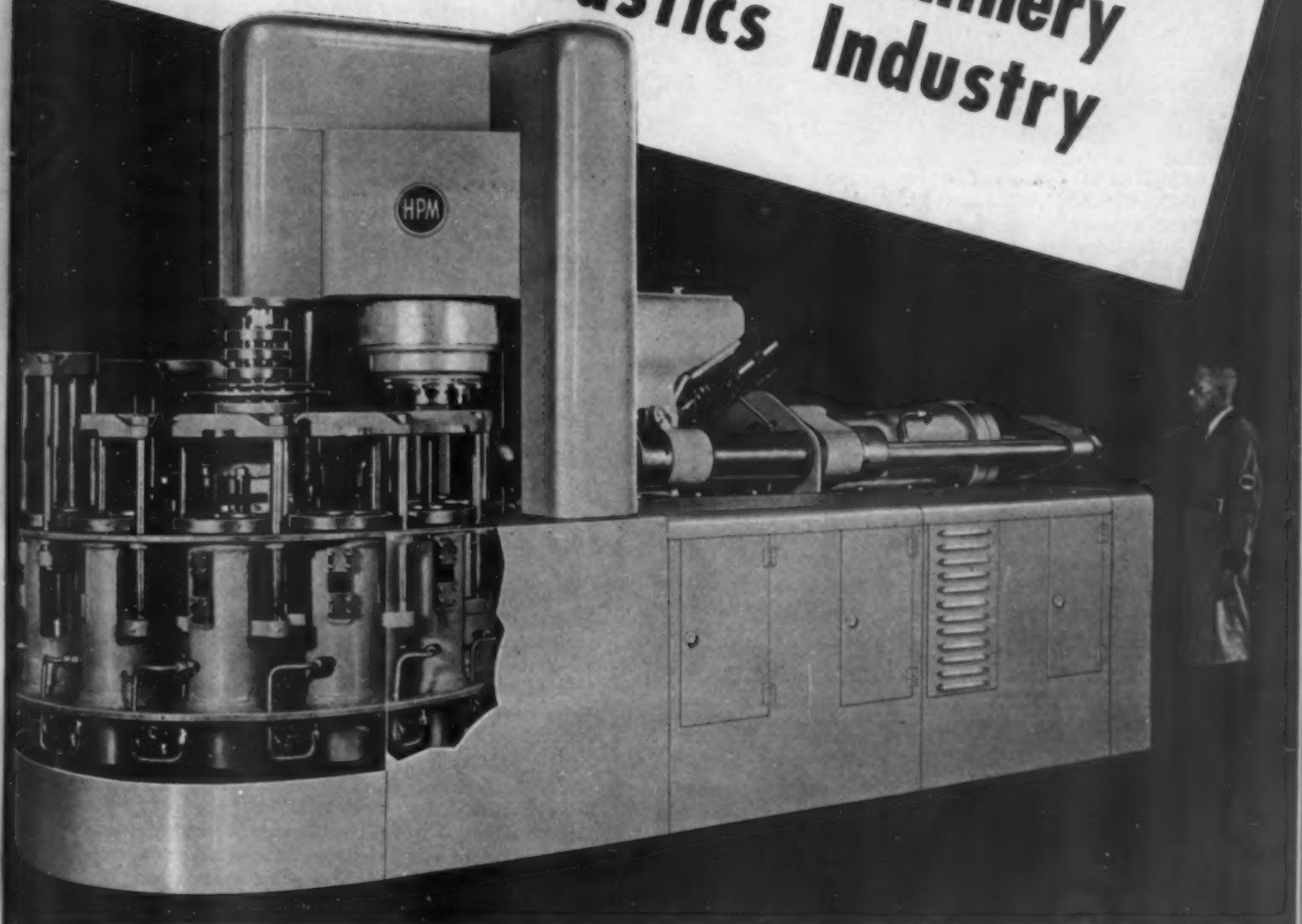
SYNTHETIC RESIN LAMINATED WOOD INSULATION. A. E. L. Jervis. British Plastics *15*, 223–8 (Sept. 1943). Uses of laminated wood for insulation purposes are listed as switch panels, terminal boards, operating poles, fuse handles, lift rods for oil circuit breakers, explosion pots, insulator spindles, cross-arms, transformer blocks and winding supports for motors. Various graphs present data concerning the properties of laminated wood, including surface breakdown in air and in oil, breakdown voltages, dielectric strength through laminae, impulse flashover and moisture absorption. Two types of wood laminates are considered: one is made of veneers laminated with resin film and compressed hot, and the other is made by compressing and bonding together completely impregnated veneers.

Coatings

ENGINEERING FUNDAMENTALS OF AIRCRAFT FINISHING. A. L. Johnson and J. J. Oudhoff. Aero Digest *43*, 159–60, 165–6, 171–3, 175, 249 (Sept. 1943). The various types of organic finishes used on aircraft are discussed. Wood parts first are treated with a sealer to penetrate the wood to prevent undue moisture absorption and retention. Filler then is added to fill the grain and any other holes. The surface after sanding is ready for lacquer or enamel. Certain variations from this schedule and the methods of application are discussed. The properties of cellulose nitrate, cellulose acetate and cellulose acetate butyrate dopes for finishing fabrics are compared. Directions for application and the problems encountered in the doping operations are discussed. The treatment of metal surfaces prior to coating and the application of lacquers to metal surfaces also is described. Use of finishes based on U. S. Government specifications is recommended.

WINDING-WIRE COVERING. H. C. Gee and J. F. Cowen. Elec. Review *133*, 134–6 (July 30, 1943). Wire covering coatings based on nylon were developed. Nylon has the requisite adhesion, toughness, abrasion resistance and chemical inertness, but in electrical properties it fails to reach the standard regarded as the minimum for a serviceable magnet wire. Lacquer coatings with suitable electrical properties were formulated from nylon mixed with certain thermosetting synthetic resins. These coatings do not crack when wound around a mandrel 3 times the wire diameter, after treatments for 24 hr. at 130° C., at −40° C., and after 24 hr. at 150° C. followed by extension up to 28 percent. The abrasion resistance is approximately 100 times that of enamel, and the scrape resistance approximately 15 times that of enamel. The modified nylon coatings are resistant to most organic solvents, to strong acids and to oils. Boiling alcohols, cresols, formaldehyde and phenol soften the coating. The conventional enamel coatings have 3 times the thermoplastic flow of the modified nylon coatings. These new coatings are also more resistant to oxidation than enamels.

This machine is typical of H·P·M's ability to design and build production machinery for the Plastics Industry



Patented and Patents Applied for—The H. P. M. Co.

This H-P-M turret type injection machine for molding thermo-setting resins is of revolutionary design — incorporating new mass production features. Installed in the plant of one of America's largest builders of automobiles, this H-P-M injection machine is molding thermo-setting parts at a rate never before obtained.

Basically the machine incorporates a turret with several mold stations. Each station is fitted with an individual injection mold. After the heated material is injected into mold, the turret indexes automatically so that the next mold can be filled. The molds are electrically heated and clamped by hydraulic pressure, consequently the plastic parts are cured in the molds as the turret revolves.

If you are planning to purchase new plastics molding machinery — be sure to investigate what H-P-M can offer you — gain the experience of the pioneer builder.

HPM

"All-Hydraulic PLASTICS MOLDING MACHINES"

The Hydraulic Press Mfg. Company
Mount Gilead, Ohio, U. S. A.

District Sales Offices: New York, Syracuse, Detroit, and Chicago. Representatives in Principal Cities.

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

PLASTIC BUTTON. D. S. Hart and A. D. Cronk (to Patent Button Co.). U. S. 2,327,521, August 24. An orientatable button head of the tack fastener type molded from plastic material.

SHEET MATERIAL. G. J. Esselen (to Monsanto Chemical Co.). U. S. 2,327,627, August 24. A continuous sheet of a polyvinyl resin is formed by extruding substantially fluid material upon a moving belt, heating while on the belt and subsequently cooling and removing the resin sheet.

LAMINATED GLASS. L. P. Kyrides (to Monsanto Chemical Co.). U. S. 2,327,627, August 24. A vinyl acetal resin, modified with a dibenzyl or ditetrahydrofurfural ester of thiodiglycolic acid or homologues thereof, is used to laminate glass plates.

SHEET MATERIAL. E. K. Carver (to Eastman Kodak Co.). U. S. 2,327,765, August 24. Films of resins, which adhere to metal, are cast on a surface of gelatin swollen with water, dried and stripped from the still swollen gelatin surface.

CELLULOSE ESTERS. C. L. Crane (to Eastman Kodak Co.). U. S. 2,327,770, August 24. A fatty ester of cellulose is dissolved in a water miscible organic solvent, a mineral acid hydrolyzing catalyst together with a hydrolyst are added, and the solution is maintained until a high acyl content is attained.

AMINOPLAST. G. F. D'Alelio (to General Electric Co.). U. S. 2,327,772, August 24. An aminoplast modified with a nitrogenous compound such as an aryl compound containing a sulfonamide radical and a ureidomethylamino radical, and aldehyde reaction products of the aryl compounds.

GRINDING WHEEL. S. S. Kistler (to Norton Co.). U. S. 2,327,846, August 24. A grinding wheel comprising abrasive grains, and acid insoluble organic bond and a filler of polyvinyl chloride.

SYNTHETIC FIBERS. J. Dahle (to Pro-phy-lac-tic Brush Co.). U. S. 2,327,872, August 24. A mass of a polyvinyl compound containing unreacted hydroxyl groups is stretched beyond its elastic limit and while under tension is reacted with a carboxylic acid, an aldehyde or a ketone.

UREA-FORMALDEHYDE RESIN. H. J. West (to American Cyanamid Co.). U. S. 2,327,984, August 31. Urea and aqueous formaldehyde are reacted with a high molecular weight aliphatic alcohol in the presence of a low molecular weight aliphatic alcohol under acid conditions.

ISOTHIOCYANATE POLYMER. V. V. Alderman and D. D. Coffman (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,327,985, August 31. A polymer of an acyl isothiocyanate having an ethylenic double bond between the carbons alpha and beta to the active group.

ADHESIVE TAPE. R. I. Coulter (to Minnesota Mining and Mfg. Co.). U. S. 2,328,057, August 31. Adhesive tape consisting of regenerated cellulose backing, a priming layer composed of rubber latex, polyvinyl alcohol insolubilized with formaldehyde, and an adhesive overlayer composed of a hydrophobic rubber-type resin.

TREATMENT OF PLASTIC SHEETS. H. Dreyfus (to Celanese Corp. of America). U. S. 2,328,065, August 31. Transparent plastic sheets are surface hardened by superficially softening the material with heat and then chilling rapidly.

ADHESIVE TAPE. R. G. Drew (to Minnesota Mining and Mfg. Co.). U. S. 2,328,066, August, 31. Adhesive tape is prepared by treating a hydrophilic cellulosic film with a primary coating of latex and a hydrophilic protein glue which is tanned, followed by addition of an adhesive overlayer which is compatible with the primer.

FILAMENTS. H. Buchsbaum and L. Becker (to S. Buchsbaum and Co.). U. S. 2,328,125, August 31. Vinyl resin mixed with a plasticizer is heated to the liquid state and drawn in filament form from the molten surface.

LIGHT POLARIZER. E. H. Land (to Polaroid Corp.). U. S. 2,328,219, August 31. A light polarizer is prepared by orientation of molecules in a sheet of transparent vinyl resin which contains a dichroic substance.

COATING. L. Balassa (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,328,249, August 31. A coating consisting of an oil-modified alkyd resin, vermiculite calcined at 600 to 750° C., other pigment, solvent and drier.

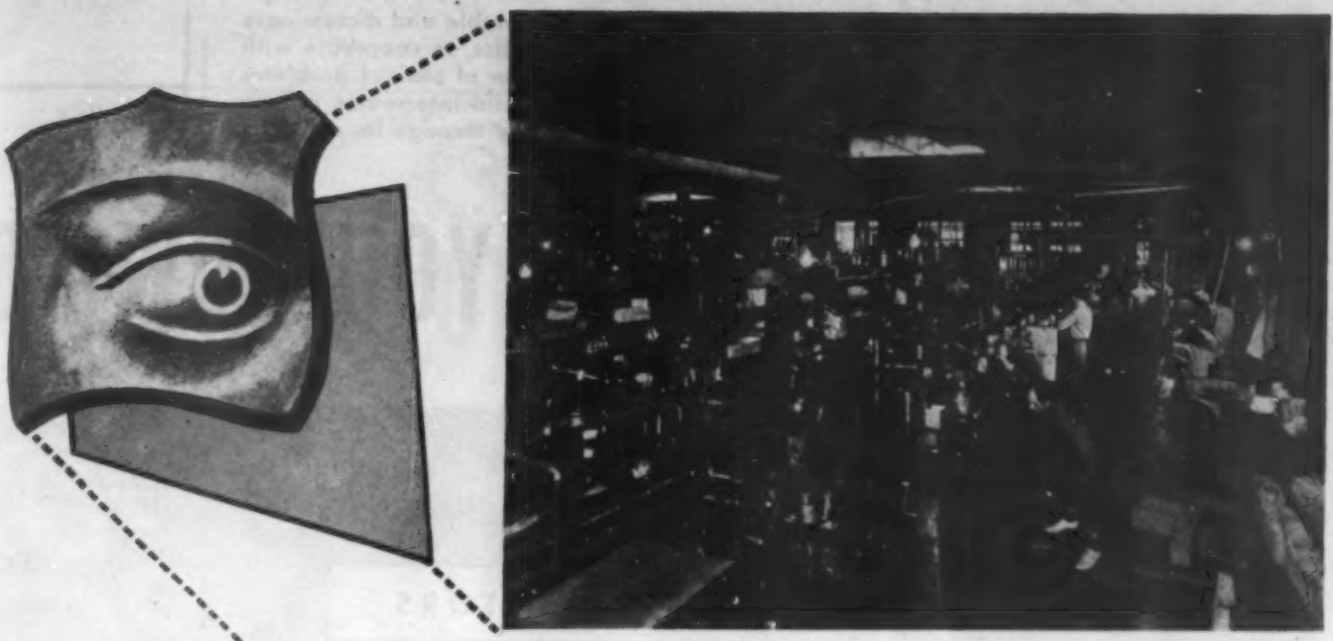
MOLDING MATERIAL. W. E. Gloor (to Hercules Powder Co.). U. S. 2,328,269, August 31. A molding composition composed of cellulose acetate and, as plasticizer, a mixture of one of the esters of phthalic acid, diethylene glycol diacetate, diethylene glycol dipropionate, glycerol triacetate or glycerol tripropionate, and triphenyl phosphate, sucrose octa-acetate, mannitol hexa-acetate, esters of glycolic acid or sulfonamids.

VINYL RESINS. R. D. Freeman and G. P. Schmelter (to Dow Chemical Co.). U. S. 2,328,333, August 31. A monovinyl compound is polymerized in a metal mold, the surfaces of which are coated with a waterproof film of a cellulose ether, over which is coated a film of water-soluble cellulose ether.

COATING. S. J. Roskosky (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,328,398, August 31. A wire enamel comprising a polyamide reaction product of monoaminomonocarboxylic acids and mixtures of diamine and dibasic carboxylic acids, and an alkyd resin, and a phenol-aldehyde resin.

UREA TRIAZINE RESINS. G. F. D'Alelio (to General Electric Co.). U. S. 2,328,424–5, August 31. Resins formed by the reactions of a chlorinated acetamide with a partial condensation product of an amidogentriazine and a preformed compound consisting of a urea containing at least 2 methylol groups attached to the nitrogen.

VINYL RESIN. C. A. Thomas (to Monsanto Chemical Co.). U. S. 2,328,510, August 31. The copolymerization product of 1-chloro, 1-fluoro ethylene and a substance containing a vinyl or substituted vinyl radical.



Take a good look at what you don't see!

Only a photo of our Compression Room, where we have over 100 presses—fully automatic, semi-automatic and hand molding presses—busy on a wide variety of jobs? Look closer!

Our experience with plastics goes way back to the days of Dr. Bakeland, when we molded the first plastic parts. (*Exactly the right plastic for your particular job!*) We make our own dies in one of the finest tool rooms you ever saw. (*Saves you time, money and insures accuracy!*) We have a flare for design that has made Plastics History. (*Talents strikingly bold and intensely practical!*) We are big enough to handle any size job but not too big to pooh pooh small jobs. (*You, too,* will like the personal service you get here!*)

Let us accept complete responsibility for your plastics problem, and show you how even your most startling ideas can be translated into practical and profitable realities.

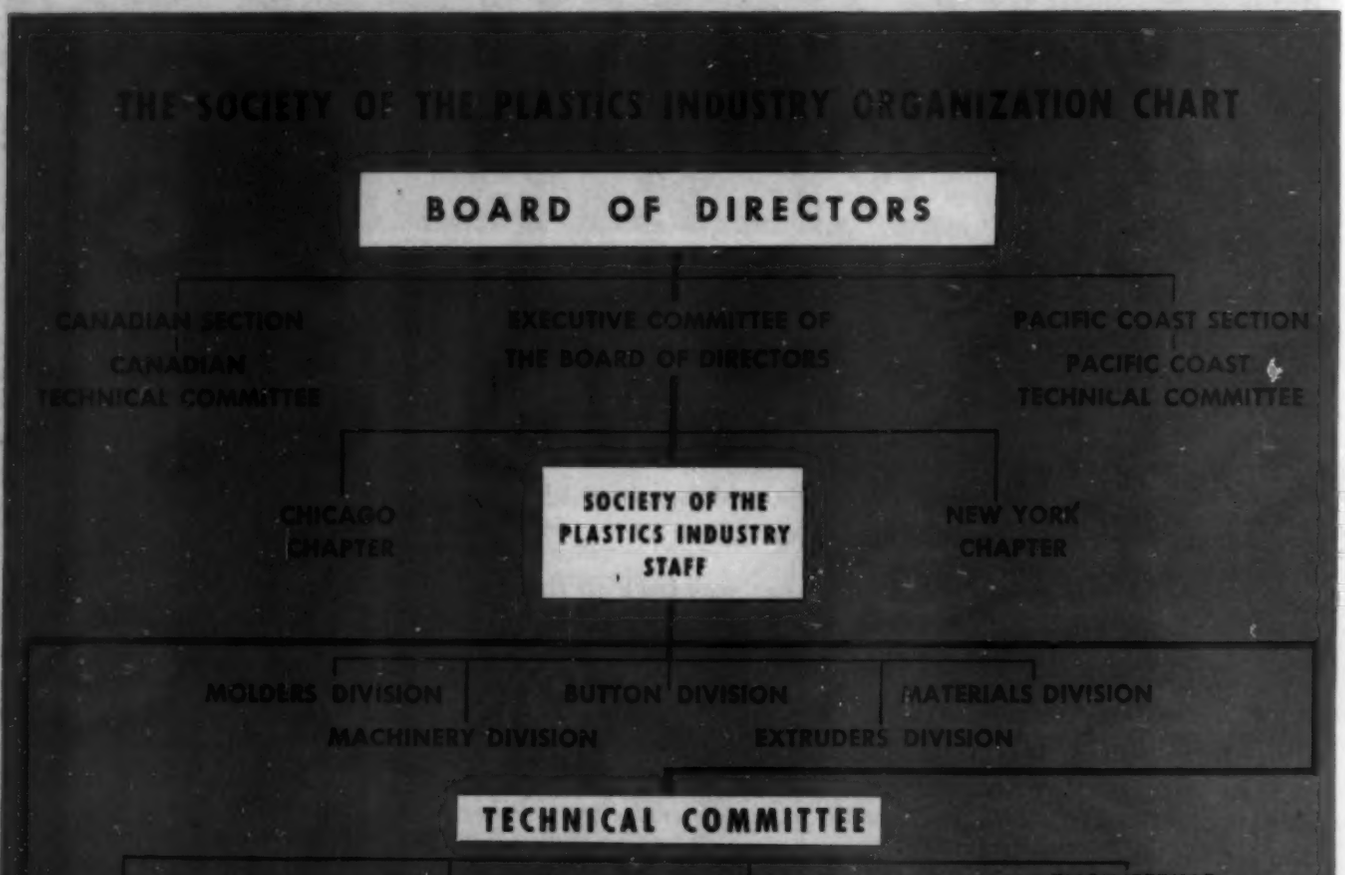
"TAKE IT TO TECH-ART"
As Do Famous Instrument Makers
"TAKE IT TO TECH-ART"
As Do Experienced Purchasers of Precision Parts
"TAKE IT TO TECH-ART"
As Do New Plastics Users with Problems

BB

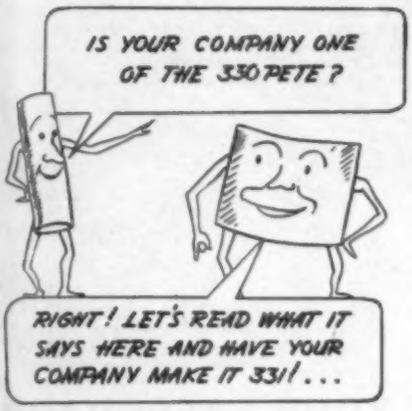
TECH-ART PLASTICS COMPANY
(Pioneer Molders—Established 1891)
Successors to Boonton Rubber Mfg. Co.
36th Avenue and 41st Street · Long Island City, New York
AStoria 8-6050-1

The Society of the Plastics Industry was formed to assemble and disseminate scientific, engineering, and other information on plastics, to cooperate with the United States and Canadian services in the solution of plastics problems of its military and allied departments, to promote social intercourse among those engaged in the plastics industries and generally through its activities to advance the application and use of plastics.

THIS CHART SHOWS YOU HOW TO



GET A PILE OF HELP ON PLASTICS



Three hundred and thirty companies, and their key personnel, form the S. P. I. to exchange information and receive aid on today's plastics problems. If your company is a non-member, this message is especially for you.

The Society of the Plastics Industry is your organization. It exists to help you meet your specific problems and those of the industry in war and peace. Your company—every company—will benefit from membership in it.

Chartered in 1935 the S.P.I. went through the usual growing pains in pre-war years. In 1941 its membership listed only 35 companies among those engaged in the plastics business, in the making of plastics machinery or in businesses closely related to the plastics industry.

But the needs of a nation at war . . . the many new problems of speeded-up production . . . the necessity for close cooperation within the industry—brought new blood and life into the Society. Now 330 companies are members. And many key men in those firms have individual memberships.

War Effort Proves Value of S. P. I.—During the last two years the Society has naturally put war work first. Its members have given essential engineering service to the government. Its technical committees have been working with the U. S. Naval Observatory, the Naval Aircraft Factory, the U. S. Army Quartermaster Corps, the U. S. Army Ordnance Department, the U. S. Army Air Corps, and the U. S. Army Signal Corps. They have acted as advisers to the Ministry of Supply in Canada. All of this experience gained in new uses and applications of plastics in wartime adds greatly to the storehouse of knowledge which will be helpful to the Society's members and to the progress of the entire industry.

Yes, the S.P.I. is busy demonstrating its worth. But its full value to the industry and to each member will not be realized until it includes a larger membership in the industry. If your company is a non-member, it will pay you to look into the following definite benefits that result from taking part in the Society's activities:

1. Association among members leads to an exchange of ideas on specific molding and fabrication problems. In addition to regular national meetings, sessions are held by the Canadian and Pacific Coast Sections and by local Chapters in various cities.

2. Technical Organization and Service. This is the heart of the S.P.I. The organization includes special committees on Thermosetting and Thermoplastic Plastics, Resin Adhesives and the Engineering Classification of Plastics. These committees are building engineering data on materials and processes. Their work has been of great help in designing war material. This experience and their knowledge of new applications and the solution of the industry's production problems will be invaluable to all S.P.I. technical members.

3. Wartime Information. A vital service to S.P.I. members is a series of authoritative, regular and special bulletins which have been keeping members up-to-date on Government rules and regulations, on new plastics applications and uses, and on new methods, materials and standards decided on by the industry. Other information of particular value comprises facts and figures which S.P.I. can offer to aid its molder members in their relations with the W.P.B. and the W.L.B. and to help participating molders and fabricators in connection with tax problems and renegotiation of contracts.

4. Post-War Planning. It's not too soon to begin charting the course of your plastics business after peace is declared. The S.P.I. has a complete set-up under a control committee, which has already started to function. The findings of these bodies will be important to every Society member and the life of the industry in peacetime.

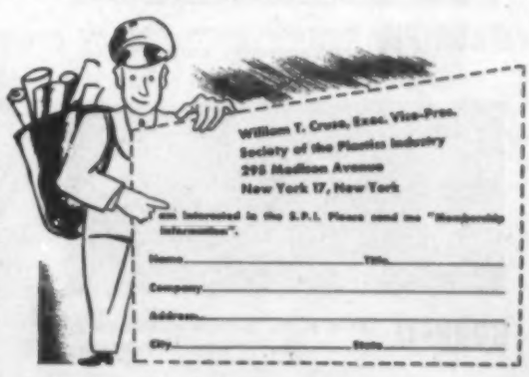
What to do about it
(If you are a non-member)

These are highspot advantages that every Society member can enjoy. More detailed information will be gladly furnished by William T. Cruse, Executive Vice-President of the Society. The S.P.I. is your organization. You can make it your company's Intelligence Department and a technical adviser simply by becoming a member. There are six classes of company memberships. Individual membership is open to those employed by company members or engaged in engineering or designing plastics.

THIS COUPON MAKES IT EASY FOR YOU TO TAKE THE FIRST STEP.

ATTENTION: S. P. I. MEMBERS

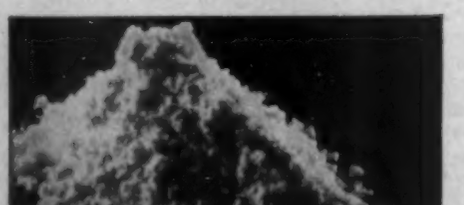
A Society of the Plastics Industry Directory is just about ready for distribution to members only. This useful book contains lists of S.P.I. members and of products made from plastics. Also a "Who's Who" of the Plastics Industry. If you do not receive your copy by December 1st, write William T. Cruse, 295 Madison Avenue, New York 17, N. Y.



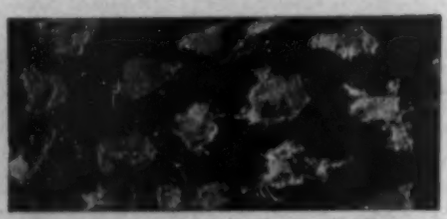
RAYCO QUALITY IS YOUR SAFEGUARD

Dependable uniformity, cleanliness and purity characterize all Rayco fillers. Quality is carefully controlled in order that users of Rayco-filled compounds may enjoy the maximum of good molding properties, and receive the maximum of strength in the finished product. Rayco cotton "Filfloc," cut to tiny but uniform lengths, imparts a definite increase in strength compared with wood flour filler. The fabric particles in Rayco "Fabrifil" are macerated under careful control to effect an even-flowing compound. "Cordfil" offers the outstanding strength of high grade cotton tire cord in lengths ideally suited to molding use.

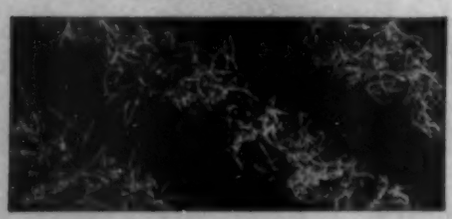
The high quality of Rayco fillers is important to you because it provides the essential foundation for high quality in your product!



FILFLOC Pure cotton flock of surpassing cleanliness and uniformity.



FABRIFIL Macerated cotton fabric for extra strength; uniformity assures good flow



CORDFIL Evenly cut lengths of tire cord; for plastics of utmost strength.

Insist on compounds containing RAYCO Fillers—for good flow and maximum strength.

RAYON PROCESSING CO. of R.I. INC.

60 TREMONT ST., CENTRAL FALLS, RHODE ISLAND

Developers and Producers of Cotton Fillers for Plastics

William Lescaze, architect, is credited with the first modern skyscraper (for the Philadelphia Savings Fund Society), and the first use of glass brick in a facade. Outstanding examples of his work include Columbia Broadcasting's Hollywood Studios, the Ansonia (Conn.) High School, and Longfellow Bldg., Washington, D. C.

FROM A PILOT SEAT . . . AND RUBBER-LIKE SAFLEX . . . SOLID COMFORT, MASS PRODUCED?

STRONG, lightweight pilot seats of plastics-bonded plywood now in quantity production for the U. S. Air Forces were the principal inspiration for this interesting suggestion for 194X by well-known, New York Architect William Lescaze.

Wartime success, however, in converting Monsanto's Saflex from its original function as a tough, resilient interlayer for safety glass into what amounts to a new and promising synthetic rubber, also interested Mr. Lescaze and led him to include Saflex in his "specifications".

Making use of war-stimulated bag-molding techniques, the chair Mr. Lescaze visualizes would be quickly and easily formed on inexpensive molds with little or no waste of material. It would be upholstered with a resilient, sponge-like Saflex and covered with a waterproof, washable, Saflex-coated fabric.

The sketches below illustrate details.

Wood plys, coated with a Resinox phenolic bonding resin, would be laid up on simple, inexpensive wood molds, tacked in place.

Molds would be covered with rubber bag and air evacuated to form snug fit. Entire assembly then goes into pressure chamber.

Removed from mold, chair is one tough, resilient, monolithic piece. Sponge-Saflex cushion would be slipped on frame like an envelope.

The Broad and Versatile Family of Monsanto Plastics

(Trade names designate Monsanto's exclusive formulations of these basic plastic materials)

LUSTRON (polystyrene) • SAFLEX (vinyl acetal) • NITRON (cellulose nitrate) • FIBESTOS (cellulose acetate) • OPALON (cast phenolic resin) RESINOX (phenolic compounds)

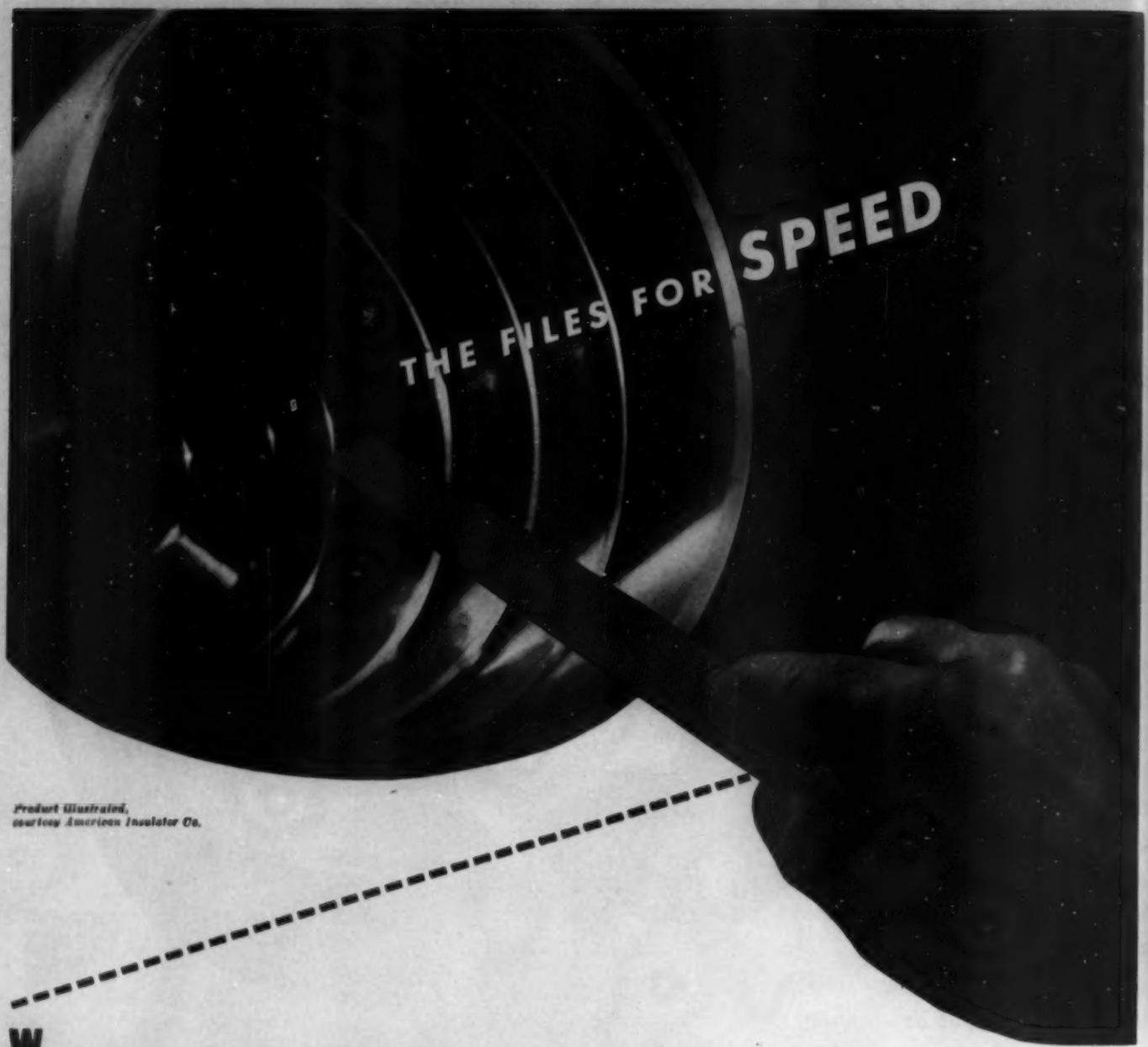
Sheets • Rods • Tubes • Molding Compounds • Castings • Vuepak Rigid Transparent Packaging Materials

MONSANTO PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

FACTS TO HELP *YOU* SHAPE THE FUTURE

No one can say today with certainty that a chair such as Mr. Lescaze has suggested will ever be produced. It *is* certain, however, that wartime advances in plastics materials and techniques *will* exert a strong influence over the shape of many things to come. That is why it will pay you to add "The Family of Monsanto Plastics, A Guide for Product Designers," to your postwar file now. Its 24 pages are packed with facts on one of the largest and most versatile groups of plastics produced by any one manufacturer. Simply write: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield, Massachusetts.



Product illustrated, courtesy American Insulator Co.

WHETHER trimming, smoothing or fitting plastic parts, it's speed—with efficiency—that is demanded today in filing operations. This speed must take into consideration the shape of the part, the amount of material to be removed, and the character of the material being worked upon. Hardness, softness, brittleness, flexibility, tensile strength — all complicate the working factors and have much to do with selecting *The right file for the job.*

Nicholson has made a study of operations involving plastics filing. For most uses the files should have thin-topped teeth, plus fairly wide gullets to minimize the tendency to clog and to provide the proper "rake." (This is particularly important with softer plastics having a tendency to shred.)

Thin-topped teeth also serve to make up for the abrasive action of certain thermoplastics by continuing longer to provide sharp cutting edges as the tips wear down.

Nicholson and Black Diamond Files for plastics include a range of cuts and sizes of Flat, Mill, Square, Round and Half Round; also several types of X.F. Swiss Pattern, including Knife and Pillar. For cheerful help on the best types of files to use on specific work, send us a description of your plastic parts, material or problem. For purchasing, contact your mill-supply house.

FREE BOOK, *"FILE FILOSOPHY"* — 48 illustrated pages on regular and special purpose files; proper use, care and other information useful to production and purchasing heads, foremen, key mechanics.

NICHOLSON FILE COMPANY • 44 ACORN STREET, PROVIDENCE 1, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

WILL YOU USE *Plastics*

...and do you know where to use them?

● Amos engineers will tell you what can be done with plastics to your advantage. And our recommendations will be based on years of experience in designing and molding plastic parts and products that give complete satisfaction. Our reputation rests on our advice to you.

While we are now producing essential wartime goods, we're also helping many forward-looking companies to redesign for plastics—molded by the fast, efficient injection process—for quick production after the war. Upon request, we'll send you our 56-page picture portfolio which tells the story of Amos facilities and abilities. Write us today.

AMOS MOLDED PLASTICS, EDINBURGH, INDIANA
Division of Amos-Thompson Corporation

Amos MOLDED PLASTICS

Custom Molders of Parts and Products
BY THE INJECTION PROCESS

Amos ENGINEERS ANSWER YOUR QUESTIONS—HELP YOU DECIDE

We know where plastics *should* be used and where they *shouldn't*—as well as the right plastics to use. Pictured below are some of the men on the Amos plan board—working on a customer's problem.

• Pictured below is an old metal soap dispenser which was redesigned for plastic by Amos engineers.

• Pictured below is the new plastic soap dispenser—typical of many jobs Amos designs and molds.

MACHINERY *and* EQUIPMENT

★ BENCHMASTER TOOL CO., LOS ANGELES, CALIF., has introduced an improved vertical bench milling machine with a quick-change attachment for vertical milling, an enclosed spindle for greater safety and a new subbase for improved working height and greater rigidity. The spindle head is designed to be rotated 60° either side of center through the adjustment of the

$2^1/_2$-in. diameter arm which is clamped rigidly to the column. The entire head can be removed and replaced with an enclosed horizontal milling attachment thereby adding to the variety of jobs that can be handled. The machine stands 30 in. high and has a precision ground table 6 × 14 in. with 3 T slots. Micrometer adjustments for the table movements are operated by disengageable hand cranks while graduated dials reading in thousandths of an inch, simplify the resetting process.

★ THE PRECO PRESS, DISTRIBUTED BY KINSbacher-Murphy Co., Los Angeles, Calif., is credited by many war plants with noticeably speeding production. It has been used to laminate and mold wood, paper, plastics and powdered metallurgy, and has proved useful for compression molding of synthetic rubber, small rubber parts and plastics. It also is used for small-scale laboratory pressure tests. Standing 27.5 in. high and weighing 200 lb., the press has a 750-watt heating element cast into each 8 × 8-in. platen. Since the platens are self-levelling, adjustments are said to be unnecessary. The press is equipped with dual thermostatic controls while a specially designed and patented 2-stage hydraulic pump provides rapid closure of the platens to the point of contact, then automatically shifts to low speed until desired pressure is reached.

★ AIROP, INC., DEARBORN, MICH., HAS INTRODUCED a new device designed for activating toggle clamps. Marketed under the name of "Airop" the unit was developed to hold down large parts or assemblies where clamps would be required to encircle a job. Since the devices can be controlled from a central valve and made to operate simultaneously or at staggered intervals, they save the operator many steps since otherwise he would be forced to walk around the work repeatedly to manipulate the many clamps. Airop consists of a cast metal cylinder which houses a plunger connected with a toggle clamp. Pivoted to the base, the cylinder can rock freely to conform with the changing angle of the plunger as it moves back and forth activated by air.

★ A NEW GENERAL PURPOSE MARKING MACHINE has been introduced by Jas. H. Matthews & Co., Pittsburgh, Pa., for use in marking of part numbers, patent numbers, names, trade-marks and special lettering or designs on a range of shapes and sizes of parts up to 6 in. in diameter or thickness. Flat parts are said to be marked legibly by means of solid roller dies or mortised roller dies and interchangeable segment type while round parts are marked with flat dies or interchangeable steel type. The unit can be furnished with a motorized unit or with a pneumatic attachment.

★ A SMALL HAND SANDER WHICH WEIGHS APPROXImately 6 lb. and which has a speed of 3500 oscillations per min., has been designed by Sundstrand Machine Tool Co., Rockford, Ill., for all practical hand sanding and finishing operations. Capable of being equipped with different types of sandpaper attachments for large or small, wide or narrow, flat or curved abraiding surfaces on metal, wood, plastics or composition, the machine is operated with pad movements started and controlled by a palm lever fitted at the top of the housing. Free from vibration, the sander is said to increase the life of abrasive paper.

★ SIX MEANS OF SPEEDING WORK ARE CLAIMED for the portable elevating tables brought out by Lyon-Raymond Corp., Greene, N. Y. With a capacity of 2000 lb., the tables can be used to move dies in and out of presses or storage spaces, in elevating or revolving work to convenient positions for work, in transferring materials from one machine to another or from one level to another, in lifting or supporting overhanging work and in fabricating and assembling operations. Mounted on casters the 30 by 30-in. table has a 14-in. elevation.

★ TRAV-LER KARENOLA RADIO AND TELEVISION Corp., Chicago, Ill., has brought out a junction box set. This unit consists of a length of 2-conductor, tinsel cordage with a 2-conductor plug attached to the cordage on one end and a junction box attached on the other end. The lower section of the plastic junction box case has 2 silver-plated copper terminal jumpers and 4 terminal binding posts for necessary connections. Rigid cord clamps are molded into both halves of the box to prevent the cordage from slipping. The unit is said to withstand all U. S. Army Signal Corps tests and to meet their specifications.

★ SOLE MANUFACTURING RIGHTS FOR THE BAshore Resiliometer, formerly manufactured by Testing Equipment Co., have been acquired by Precision Scientific Co., Chicago, Ill. The instrument is designed to measure the resiliency of rubber and extensible plastic compounds by indicating the rebound of a weighted plunger dropped from a predetermined height. It has been used for measuring rate and state of cure, for matching competitive compounds, for factory control tests on batches of cured and uncured compounds, and for measuring plasticity of uncured compounds and masticated rubber.

★ ROBERT H. CLARK CO., LOS ANGELES, CALIF., HAS designed a new thread-tool grinding fixture for grinding both 60° and 29° threading tool bits. There is said to be no graduated scales or moving parts in the new fixture. The bit is slid into the holder, a set screw tightened and the fixture placed on the grinder work table properly positioned for the thread angle desired. The bit holders, available in 2 standard sizes, will securely hold round or square bits of all sizes from $^1/_8$ to $^5/_8$ in. for cutting both right and left hand threads. The unit may be used on any surface grinder or cutter grinder and is made of high permeability steel for maximum holding value and long life.

★ CAPABLE OF CUTTING PLASTICS AS WELL AS metals, wood and paper, a new band saw has been introduced by Boice-Crane Co., Toledo, Ohio, which can saw stock $8^1/_8$ in. thick and handle work 27 in. in diameter. Blades from $^1/_4$ in. to $^3/_4$ in. can be used while 8 speeds are provided to suit every blade and every material. Heavy duty gears transmit up to 1 hp at lowest speed.

STOKES PREFORM PRESSES

SINGLE-PUNCH PRESSES for General-Purpose Preforming. Readily changed from one job to another. Production rates up to 50 or more per minute.

ROTARY PRESSES for High-Speed Production . . . Ball or Standard Shaped Preforms. Production rates up to 1,000 per minute.

TOGGLE-TYPE PRESSES for Heavy-Duty Preforming. Pressures up to 80 tons. 40 or 50 strokes per minute.

Single-Punch General-Purpose Presses
High-Speed Rotary Type Presses

Stokes Automatic Preform Presses, for precompressing molding powders into tablets or pills of uniform weight, density and form, are available in types and capacities to meet every requirement. We build stock model Single-Punch, Toggle-Type and Rotary Presses to apply pressures up to 80 tons, also presses from 100 to 300 tons capacity to meet special requirements.

All are simple, practical machines, built for hard, continuous service and fully protected against damage from overloads and jamming. Construction is particularly rugged. Frames are semi-steel, combining the rigidity of castings with the strength of steel plate. Gears are well guarded. Bearings are large, and bronze bushed. Simple adjustments to control pressure, density, weight and thickness may be made while machines are running.

Variable speed drives assure maximum production with various materials and on preforms of different size. Special shaped punches and dies or those to produce perforated preforms may be used. Presses are quickly changed over from one job to another.

Write for new catalog No. 427 showing improved model Stokes "Standard" Semi-automatic Molding Presses and various models of Stokes Preform Presses.

Write for new catalog No. 427 showing improved model Stokes "Standard" Semi - automatic Molding Presses and various models of Stokes preform Presses.

F. J. STOKES MACHINE COMPANY
5934 Tabor Road Olney P. O. Philadelphia, Pa.

Representatives in New York, Chicago, Cincinnati, St. Louis, Cleveland, Detroit

Pacific Coast Representative L. H. Butcher Company, Inc.

F.J.Stokes MOLDING EQUIPMENT FJS Est. 1895

PUBLICATIONS

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices

Fundamentals of Radio

by L. O. Gorder and K. A. Hathaway

American Technical Society, Drexel Ave. at 58th St., Chicago, Ill.

Price $2.00 **351 pages**

The fourth in a series of pre-induction textbooks, this book was prepared in accordance with an outline supplied by the United States Office of Education and the War Department. The text is designed to supply the basic knowledge necessary for training in radio jobs in the Army Air Forces, Army Ground Forces and Service of Supply. The material deals with the fundametal principles of radio and the manner in which these principles are applied to radio transmitting and receiving sets. Mathematics are kept to the substitution of numerical values in the formula, all of which are worked by simple arithmetic. L.E.M.

★ TWO BULLETINS HAVE JUST BEEN ISSUED BY Watson-Stillman Co., Roselle, N. J. No. 350-A describes in full the company's line of hydraulic laboratory presses and equipment. Large illustrations supplement the verbal descriptions. Bulletin No. 250-A presents the company's Stediflo hydraulic pressure pumps. These pumps, available in standard sizes from 3 to 200 hp. for pressures of 1500 to 10,000 p.s.i., are given a comprehensive coverage. Copies are available upon request on a business letterhead.

★ "FIREPROOFING OF TEXTILES" HAS JUST BEEN issued by Textile Research Institute, Inc., discussing the theory and practice of fireproofing as applied to textiles. Materials generally used to render textiles fireproof are described, methods for testing fireproof fabrics are outlined briefly, and tables are included covering recent patents and percentage by weight of various compounds in a cotton fabric necessary to prevent flame propagation. Inquiries should be directed to the Institute at 10 E. 40th St., New York, N. Y.

★ "IDEAS THAT WORK TO WIN" IS THE TITLE OF A small booklet just published by the Industrial Incentive Div., Navy Dept., 2118 Massachusetts Ave., Washington, D. C. The pamphlet is intended as a guide to management in establishing and conducting various incentive measures to stimulate production in Navy contract plants. Copies are available at the address given above.

★ "PLASTICS IN PEACE-TIME" IS THE TITLE OF THE first of a series of industry studies reprinted from the August issue of *Trust and Estates Magazine*, New York, N. Y. In addition to stressing the versatility of plastics, attention is given to special properties and limitations of the material. Special note is taken of the impetus given the industry by the war.

★ CATALOG NO. 103 JUST ISSUED BY KURZ-KASCH, Inc., Dayton, Ohio, lists the types of plastic knobs, dials and control balls supplied by this company. Detailed photographs of its products are supplemented by cross section drawings and dimension charts.

★ TYPICAL CUSTOMER TESTS FILL 30 of the 40 pages that go to make up the catalog on precision saws published by Doall Co., Des Plaines, Ill. Laboratory reports from various manufacturers, discussing the performance of the company saws, are interlarded with operational pictures. The last few pages of the booklet are filled with statistical information on saw widths, types of saws, set and temper. A chart has been devised to simplify the task of selecting the proper saw for a particular job.

★ "WOOD PRESERVATIVES" IS THE TITLE OF A pamphlet recently published by I. F. Laucks, Inc., Chicago, Ill. A brief summary of preservatives available from the company is followed by a discussion of the need for protecting wood and a full description of specific company treatments for a variety of wood products. A chart on the final page of the pamphlet serves as an easy guide to the properties of the wood preservatives.

★ "INSULATING MATERIALS" IS THE TITLE OF A well-indexed catalog published by the Resin and Insulating Materials Div., General Electric Co., Schenectady, N. Y. Numerous illustrations are scattered through the 10 sections of this book which deal with varnish cloth, varnishes and compounds, glyptals, paper and fiber, tapes, cords and varnish tubings, mica, wedges and soldering materials, cement and hand cream. Specification and property charts are included.

★ WITH THE ADDITION OF A SECTION COMPRISING brief biographical sketches of the great men of science, Zenith Radio Corp., Chicago, Ill., has brought its reference book, "Trail Blazers to Radionics and Reference Guide to Ultra High Frequencies," up to date. The second half of this small book is devoted to a bibliography of existing literature about frequency modulation. Designed for use by engineers, the book is being received enthusiastically in colleges and Army training centers.

★ YOUNGSTOWN-MILLER CO., SANDUSKY, OHIO, HAS announced a new folder describing its line of lubricating and hydraulic oil reclaimers. Covering reclaimers with capacities ranging from 2½ gal. in 70 to 90 min. to 120 gal. in the same length of time, the booklet describes the units as being adapted to the restoring of all types of used oils including oils drained from aircraft engines, Diesel locomotives, gear reducers and compressors, without presettling or pretreatment.

★ A NEW BOOKLET ISSUED BY UNITED STATES PLYwood Corp., New York, N. Y., emphasizes the many new developments which the war has brought to the plywood industry and stresses the peacetime applications of these developments. More than 30 photographs of wartime uses of plywood are included in the leaflet showing not only flat plywood products but molded, metal-faced, waterproof and tubular products. Several pages are devoted to aircraft parts while another page shows recent developments in the boat field.

★ A 16-PAGE CATALOG HAS BEEN ISSUED BY LEEDS & Northrup Co., Philadelphia, Pa., describing its portable universal pH indicator. In addition to a chapter describing the direct-reading with glass, hydrogen and quinhydrone electrodes, the book discusses the self-contained electrodes, the speed of operation, the unit's strength and its reliability. Numerous illustrations are used to give point to the text.

★ A PAMPHLET HAS BEEN BROUGHT OUT BY THE Plastics Dept., E. I. du Pont de Nemours & Co., Inc., Arlington, N. J., describing heat-resistant Lucite molding powder. After answering the question, "What is heat-resistant Lucite molding powder," the booklet lists typical uses for this powder, its physical properties and the results of tests. One section is devoted to methods of molding and extrusion.

★ ACCORDING TO A BOOKLET ON AIR CONDITIONing and industrial refrigeration just announced by Westinghouse Electric and Manufacturing Co., controlled temperature, humidity and air cleanliness mean uniform quality, precision, fewer rejections and faster production. This 20-page book illustrates and describes the exclusive hermetically sealed compressor and traces its development from 1932 to the present day. It also includes explanations and diagrams concerning the principles of air conditioning and presents the complete line of the company's equipment for air conditioning and industrial refrigeration.

rods
tubes
shapes
tapes
RIGID... to FLEXIBLE...
Compounders and Extruders of Specific Materials for Specific Uses
Synflex Compounds as developed in our own laboratories are produced only in the form of rods, tubes, shapes, tapes and elastics. These distinguished materials meet and surpass the most exacting requirements of the electrical and aviation industries. Many formulations are available, each for a specific job.
Synflex FT 10 is used for the lowest temperature applications, retaining its flexibility to −85 F. Synflex FT 11, a transparent material, is effective in a wide range of working temperatures from −60 F. to 188 F. Synflex FT 22 has a high dielectric strength and for many applications supplants varnished tubing and sleeving.
Synflex rubber-like Tubings are in continuous lengths from B. & S. #24 (.021 I.D.) to 2.000 I.D. Special sizes and shapes upon request.
Inquiries invited. We will gladly submit complete test methods, data and samples.
SYNFLEX
INDUSTRIAL SYNTHETICS CORPORATION
60 WOOLSEY STREET, IRVINGTON, NEW JERSEY

New PMMA handbook

Following more than 2 years of research and collation, the Plastics Materials Manufacturers Association has just made its first general distribution of a technical data handbook summarizing the properties of 18 principal types of plastic materials.

"Technical Data on Plastics Materials" first was envisioned as a collective effort by the manufacturers to acquaint molders with the merits and limitations of their various materials. It was spurred to completion by the need of the armed services for a standard reference work and was developed in collaboration with representatives of the armed forces, the aircraft industry and the National Bureau of Standards. The idea took form on April 7, 1942, when W. E. Emley and Dr. Gordon Kline of the National Bureau of Standards, met with the PMMA's Defense and Government Relations Committee in Washington. Mr. Emley called attention to the important defense need for more adequate plastics testing methods, and it was decided that, as distinct from the activity of the Society of the Plastics Industry in developing somewhat similar data from the standpoint of fabricators, it was the responsibility of the materials manufacturers to furnish their own information on properties of materials.

A subcommittee of 7 technical men was put to work with instructions to assemble all available testing data for comment and suggestion by representatives of the services and the Government. This preliminary work took the form of a blueprinted volume which was, in effect, the first edition of "Technical Data on Plastic Materials." Published on May 22, 1942, this first draft was not intended for general distribution and only 50 copies were assembled. It merely provided the framework on which the present comprehensive volume was constructed.

A meeting of the Chemical Branch of the War Production Board, Plastics Section, on June 18, 1942, was devoted to study and discussion of this preliminary volume, and it was concluded that extensive additional tests of materials and collation of their results, would be necessary to meet the needs of the war effort. This meeting was presided over by L. M. Rossi of Bakelite Corp., and the industry was represented also by John H. Adams and C. W. Blount of Bakelite Corp.; Willard F. Bartoe of Rohm & Haas Co.; L. L. Beck of Catalin Corp.; M. H. Bigelow of Plaskon Div., Libby-Owens Glass Co.; John C. Brooks and H. K. Nason of Monsanto Chemical Co.; H. W. Paine and A. E. Pitcher of E. I. du Pont de Nemours & Co., Inc.; and L. W. A. Meyer of Tennessee Eastman Corp.

Suggestions advanced by Army, Navy and Bureau of Standards men at this meeting gave final form to the data book, but the additional research required necessitated nearly a year's additional work before the book finally was published on August 15 of this year. Fundamentally the revision broadened the data from that bearing on familiar peace time applications—principally electrical properties—to the radically different military requirements with the stress placed on physical and chemical tests.

As finally published the handbook, bound in maroon paperboard covers with a spiral of paper laminate, is a neat job of format and printing. The title pages include a list of the 18 member companies of the PMMA, and a 3-page introduction outlines the purpose of the volume: "To acquaint its user with the nature, particular merits and utility of various plastic materials and with property values, as measured by recognized methods, commonly to be expected in available forms and modifications of the various basic compositions."

Materials for which data are given are: casein plastic, cast phenolic resins, cellulose acetates, cellulose acetate butyrates, cellulose nitrate, ethyl celluloses, laminated phenolic plates, rods and tubes, melamine molding materials, methyl methacrylates, nylon, phenol-formaldehyde molding materials, phenol-furfural molding materials, polystyrenes, polyvinyl formulas, acetals and butyrals, polyvinyl chloride plastics, urea-formaldehyde molding materials, vinylidene chloride (saran) and vinyl chloride-acetate resin compounds. In the main body of the book, each of these materials is taken up in order. In each case an explanatory foreward—describing the material, its characteristics and recommended processing—is followed by more detailed tables and explanatory charts.

For each material, there are 2 pages of tables—one on a pink sheet listing properties bearing primarily on fabrication, and one on a yellow sheet indicating strength of the finished product. The pink-sheet table contains 2 sections: items relating to ease of fabrication, and values from miscellaneous tests. The yellow sheet covers values from electrical tests, values from mechanical tests and values from fatigue tests. In many cases there are graphs on the backs of the tabular sheets illustrating effects of temperature and humidity on test values, covering such values as impact strength, compressive and flexural strength.

Tubular values often elaborated upon in footnotes which are clear and concise, add much to the value of the entire book. Explanatory forewords often run to 2 or more pages, and there is evident intention to provide every available scrap of verified information. Tables for some of the more active materials—such as the cellulose acetates, cast phenolic resins, phenol-formaldehyde and furfural-aldehyde-phenol molding materials, laminated phenolic tubing and plate—run to such length laterally that the pages containing them are accordion-folded into the book.

Finally, there are pink and yellow tables summarizing the values for all the plastic materials in the manner originated by the PLASTICS CATALOG. These tables permit a rapid survey of test values for the various materials in ascertaining what materials exhibit the values desired. The foreword to the tables wisely explains that, "Unfortunately, exactly the same methods of test have not been equally suitable for all materials. To that extent all values presented for the same property in different materials may not be equally comparable. Such apparent inequality in the data will be lessened, however, if it is remembered that many test values cannot be translated exactly into values to be expected in commercial moldings or articles. Factors of design, fabrication, atmospheric conditions, rates of stressing, etc., complicate the translation so that reported data must be taken as being somewhat rough rather than precise property evaluations."

Throughout the book, no attempt is made to show minor differences between materials which for many practical purposes are essentially alike or at least very similar. Where a range in value for a property is given it may signify either (1) the range within which the values for all members of the group described will fall, or (2) approximately the variation which should be expected and allowed for from lot to lot or batch to batch for any member of the group. In many cases it has been possible to "type" materials so closely that ranges in value shown are much more nearly the latter. The yardsticks of measurement chosen for the tables are the test specimens and methods of test which have been adopted as standards or tentative standards by the American Society for Testing Materials.

"Where it is possible to choose methods of molding," the book's introduction warns, "it should be remembered that the production of an at least apparently sound piece becomes almost wholly dependent upon the conditions to which the molding material is subjected. Some materials may mold more readily than others, or may appear to do so, but despite any initial lack of success with an unfamiliar material, it should be obvious that no material offered for sale by a reputable manufacturer can be wholly bad. It also should hardly be expected that all molding operations will be found equally suitable for all materials and all jobs.

Toward this end, "Technical Data on Plastic Materials" is a notable first step. Considering the difficulty of standardizing results to be expected from plastic materials, it is a good job. It is to be hoped that in future editions the gaps existing in many tables will be filled in and that perfection of standard testing methods will permit even more precise delineation of the qualities of various plastic compositions. Copies may be obtained by responsible persons within the industry at $1.50 per copy, by addressing the Plastic Materials Manufacturers Association, Tower Building, 14th and K Sts., Washington, D. C.

DO YOU KNOW WHETHER YOUR PLASTIC WILL DO THE JOB

Do you *know* if the Plastic you have selected for a particular job will meet *all* the requirements?

When you have Plastics tested for certain definite properties, you want practical results and figures . . . results you can count on.

We are equipped to duplicate the actual molding and laminating procedures the Plastics will undergo in actual usage, and test them on every conceivable basis, physical or chemical, from a simple strength test to an involved test of practical application.

Write for our price list of routine tests

* Member of A. C. C. L.

UNITED STATES TESTING COMPANY, INC.

* American Council of Commercial Laboratories

ESTABLISHED 1880

HOBOKEN, NEW JERSEY

PHILADELPHIA, PA. GREENSBORO, N. C. WOONSOCKET, R. I. CHICAGO, ILL. NEW YORK, N. Y.

WASHINGTON ROUND-UP

Current news, Government orders and regulations affecting the plastic industry, with analysis of the plastic situation prepared by R. L. Van Boskirk, our Washington correspondent

RECTOR MOVES UP

Clinton "Pete" Rector has been named Deputy Chief, Plastics Section, Chemicals Division, War Production Board. Mr. Rector, formerly with Bakelite Corp., has been serving as Chief of the Thermosetting Unit for almost a year and a half.

COL. DORIOT TAKES ON ADDITIONAL DUTIES

Colonel George F. Doriot has been named Chief of Military Planning Division, Office of Quartermaster General, to succeed Col. David H. Cowles. He will continue as Chief of Research and Development Branch and as Materials Controller in charge of all raw materials in the Quartermaster Corps. Col. Doriot, the immediate superior of Major Hobson, is well known to many plastics manufacturers for his sympathetic understanding of the industry. He has taken an enthusiastic interest in the development of such Quartermaster items as helmet liners, canteens, rifle covers, rain coats and numerous other items. He now is on leave of absence from the Harvard School of Business Administration where he is assistant Dean and professor of manufacturing. Col. Doriot is a member of the Board of Directors of several large corporations and has been a consultant to many others.

POLYETHYLENE ALLOCATED

Polyethylene, a plastic material used in manufacturing wire and cable, and polyethylene scrap were placed under allocation by WPB through issuance of Allocation Order M-348, effective October 1. The order provides that no person shall use, deliver or accept delivery of polyethylene or polyethylene scrap after October 1 except as specifically authorized by WPB or under the exceptions allowed by the order. A supplier seeking authorization to deliver polyethylene in any month must apply on Form WPB-2946 (formerly PD-601) by the 20th of the month preceding that in which delivery is planned. A person seeking authorization to use or accept delivery of polyethylene in any month must apply on Form WPB-2945 (formerly PD-600) by the 15th of the preceding month.

Exemptions provide that any person who is not a supplier may deliver polyethylene to a supplier without specific authorization, and one 5-pound sample of polyethylene may be delivered by any supplier to any person in any month, and may be accepted and used by that person for experimental purposes without specific authorization. Polyethylene scrap may be delivered by any person to a scrap dealer and may be cleaned and sorted by a scrap dealer without specific authorization. Any person, including a scrap dealer, may deliver polyethylene scrap to any person who produces polyethylene, and the producer may reprocess it, without specific authorization. At the present time, use of polyethylene is confined strictly to military uses. It has been manufactured in small quantities in England for several years, but is relatively unknown in this country. The Government has requested that technical information on the subject be withheld.

PRICE ADJUSTMENT FOR ETHYL ACETATE

To maintain and expand the production of ethyl acetate, OPA has authorized price adjustments. A producer who desires a price adjustment can apply to OPA and show that the present maximum price subjects him to substantial hardship, that a general shortage of ethyl acetate exists and that the adjustment is necessary to permit him to continue or expand production. The price adjustment procedure is established by Amendment No. 11 to Supplementary Regulation No. 15 to GMPR, effective October 1. The general price regulation sets ceilings in accordance with the highest prices prevailing in March 1942.

ACETONE AND DIACETONE UNDER ALLOCATION

Two important solvents, acetone and diacetone, have been placed on allocation by order M-352, effective for October deliveries. No person may accept delivery in any month from all suppliers of an aggregate of more than 1750 lb. (5 drums) of acetone, or more than 2075 lb. (5 drums) in the aggregate of diacetone except on specific authorization from WPB on Form WPB-2945. Applications must be filed by the 10th of the month preceding that in which delivery is sought. To accept delivery in any month from all suppliers of more than 350 lb. but less than 1750 lb. of acetone or of more than 415 lb. but less than 2075 lb. of diacetone, a customer must file with each supplier by the 10th of the preceding month a certificate of intended use as provided in the order.

While acetone and diacetone are used for many purposes aside from plastics, they are used largely in this industry as solvents in cements which are used to hold the various parts of an item together. It is believed that transfer from the priority system to the allocation system will insure the plastics industry of a more stable supply for essential purposes.

LABORATORY RATING FOR REAGENT CHEMICALS

Preference ratings on deliveries of reagent chemicals for laboratory use were reassigned September 28 by the WPB through issuance of Preference Rating Order P-135 as amended. Preference rating AA-1 is assigned to deliveries of any reagent chemical to any laboratory to which a serial number has been assigned under Preference Rating Order P-43 governing laboratory equipment, and to any laboratory owned and operated by the Army or Navy. Preference Rating AA-2 is assigned to deliveries of any reagent chemical to any laboratory lacking a serial number under Order P-43 or to a distributor or producer of reagent chemicals. Order P-135 formerly assigned a blanket rating of AA-2X to reagent chemicals for laboratories.

MINOR INSTALLATIONS FOR MANUFACTURERS

Under a new amendment to P-89, a chemical manufacturer now can obtain items to add to an installation in order to improve production provided the cost does not exceed $500, exclusive of labor. Previously he could replace only the part that was uneconomic or worn out. The revised order also raises the small order exemption for aluminum from 100 to 500 lb. a quarter. The revision further specifies the information required when applying for special ratings for containers. These directions apply only to companies who have a serial number under P-89. Most molders operate under CMP-5 and, therefore, are *not* affected by the provisions of P-89. It is believed that CMP-5 will continue to be the most satisfactory system for obtaining MRO supplies in so far as molders are concerned.

A MAILING CARD WITH PRIORITY REQUESTS

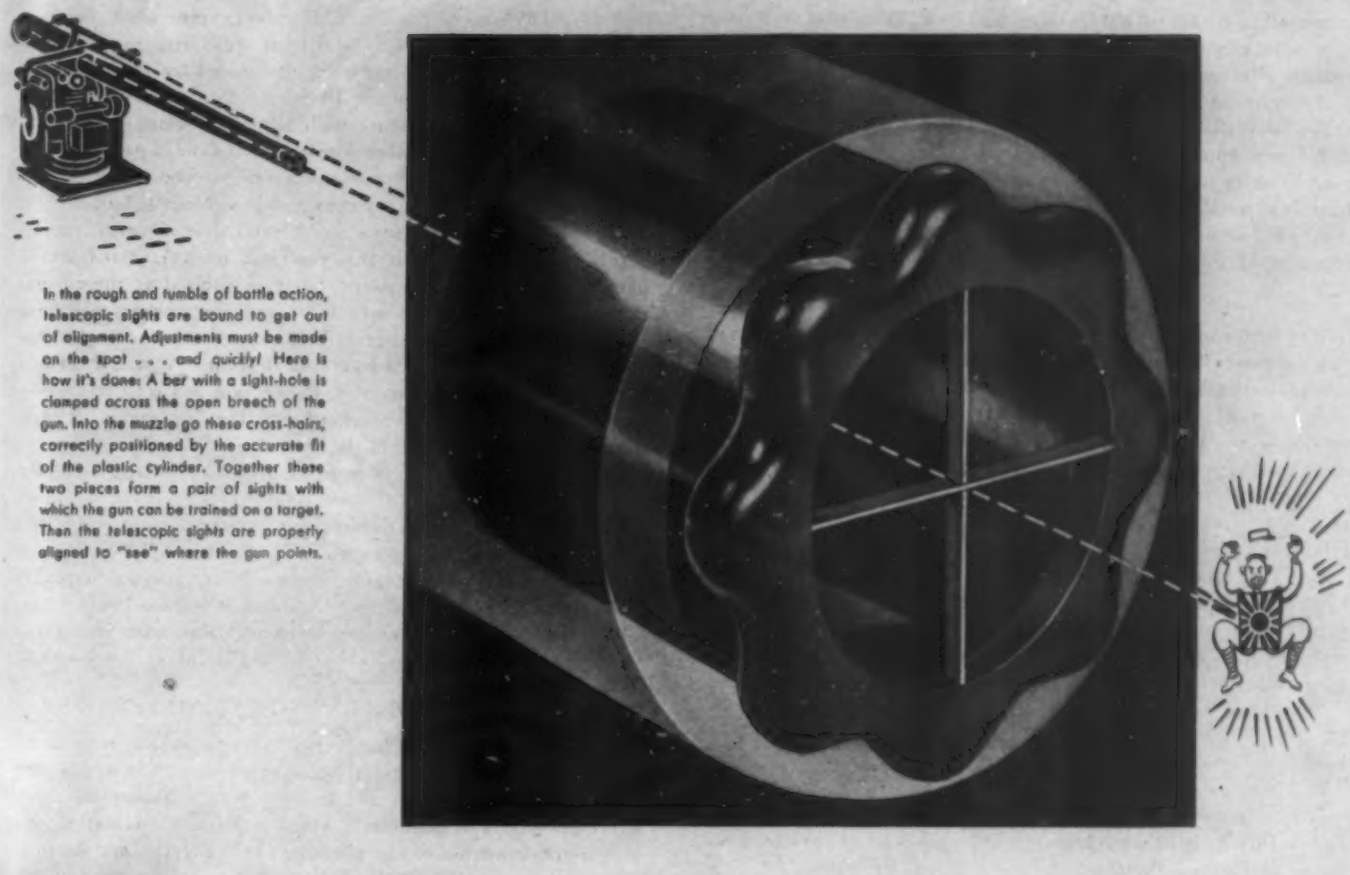
When processors request priority ratings they should include a self-addressed return card in their correspondence with a space clearly marked where the serial number of the case can be stamped. The case will be given a serial number as soon as it reaches the Field Office or Washington, and that number will be stamped on the applicant's card and immediately returned to him. This procedure will save much time in future communication concerning the request. When an applicant calls or writes Washington concerning the status of his request there is no immediate way of locating his particular request among hundreds of others unless the number is known by both parties. It can be traced quickly only when the number is known.

CHANGES IN HANDLING WPB FORMS

According to Operations Vice-Chairman H. G. Batcheller, thousands of application forms formerly routed to the WPB in Washington now will be processed in the field as a result of

Plastic Accuracy

HELPS OUR GUNS SEE STRAIGHT
TO SHOOT STRAIGHT



In the rough and tumble of battle action, telescopic sights are bound to get out of alignment. Adjustments must be made on the spot . . . and quickly! Here is how it's done: A bar with a sight-hole is clamped across the open breech of the gun. Into the muzzle go these cross-hairs, correctly positioned by the accurate fit of the plastic cylinder. Together these two pieces form a pair of sights with which the gun can be trained on a target. Then the telescopic sights are properly aligned to "see" where the gun points.

Victory, in modern war-fare, is the reward of infinite attention to a million vital trifles... like this device for correcting the alignment of telescopic gun sights.

Of prime importance, in any such device, is dimensional accuracy and stability. Perhaps that is why it was originally made of aluminum. But when the metal went to higher priority usages, plastics "took over"... with complete success. Correct design... *plus dependable production*... give this product the required accuracy and impact strength. The smooth, hard surface will not corrode, nor will it affect the metal of the gun barrel.

This device shows again what can be accomplished with the unique properties of plastics... when design, engineering and production "know-how" guide their use. We are prepared to assist you in adapting plastic properties and production methods to your parts or products. Send us your specifications for quotations, or have one of our engineers consult with you. MOLDED PRODUCTS COMPANY, 4533 W. Harrison St., Chicago (24), Ill.

PLASTICS DIVISION

MOLDED PRODUCTS

several specific measures to implement the decentralization policy.

Specifically, the changes in regional handling of WPB applications are as follows:

PD-1A applications: At present, field processing is limited to applications of less then $500 in value. This authority now is increased to applications up to a value of $1000, and after 90 days, the authority will extend to applications of a value of $2500.

Industrial Projects: On October 15, field offices were scheduled to begin processing applications up to $10,000 in value (excepting certain types of projects), and this authority is to be increased to cases of $25,000 in value or less beginning January 15, 1944.

Emergency Assistance Applications (PD-333): Field offices now process PD-333's up to a value of $500. This is to be increased to $1000 within 30 days, and to $2500 within 60 days. The authority to grant emergency AAA ratings, however, will remain with the Washington office for the time being.

Appeals: At the present time, the field offices handle appeals under 60 WPB "L" and "M" orders, and are permitted only to deny such appeals or to recommend approval. They are not permitted to make outright grants on appeals. Within the next few weeks, 136 additional orders will be referred to the field with action limited as above on 66 orders, and limited to recommendations for denial or approval on the other 70 orders.

WAGE INCREASES

The limitations within which employers may grant individual pay increases have been relaxed somewhat by WPB. A new general order permits employers of 31 or more employees to increase wages or salaries up to $5000 for merit, seniority, promotions, etc., without approval if such increases are in accordance with a schedule which consists of job classifications, wage or salary rate ranges, and a plan of making such increases within such rates and ranges. This liberalization is subject to the following restrictions:

1. The total of such increase to any individual may not exceed 10c per hour during any year, and the total amount expended on such increases during any such year may not exceed an average of 5c per hour for all employees in the establishment whose wage or salary raises are subject to the Board's jurisdiction.

2. Increases may not be made the basis of an application to the Board for the approval of increases to eliminate intraplant inequities.

3. Increases may not result in the payment to any employee of a rate in excess of the highest rate paid by the employer between July 1, 1942, and June 30, 1943, for jobs of similar skill, duties and responsibilities.

4. Such increases may not result in an appreciable increase in the level of production cost and may not furnish a basis either to increase prices or to resist a justifiable reduction in prices.

5. The increases may not be made contrary to the terms of any bargaining agreement covering any or all the employees of such employers.

The increases are limited to those made for improved quantity or quality of work or service. Increases based upon seniority or promotion still require a schedule which must have been approved or have been in effect before the start of wage stabilization.

PAPER FOR VULCANIZED FIBRE

In an amendment to order M-241-a, Oct. 5, paper for vulcanized fibre is placed officially on the unrestricted production list so that manufacturers no longer will have to worry about convincing their supplier that paper for this purpose may be classified under list A. There has been some confusion in the trade because paper for vulcanized fibre was omitted from the original order.

POLYVINYL BUTYRAL FOR CIVILIAN SAFETY-GLASS

With prospects of increased amounts of polyvinyl butyral being available for essential civilian uses, the Chemicals Division plans to allow limited amounts for civilian safety-glass. The proposed allocation policy will be based upon the applicants' past military usage of this resin, and it is planned that future allotments will be in a lump sum to each applicant. With the view of reducing the paper work necessary in industry, the applicants in the future will apply for resin for a single end use, that is, safety-glass. This will supersede the present breakdown of requirements into military, indirect military and essential civilian. It is understood, of course, that all military uses must be supplied from this total allotment, the balance then being available for civilian applications. The total amount of butyral resin available each month for safety glass will vary to some extent with other military programs. However, a minimum quota for the industry will be established.

NAVY ANNOUNCES NEW AIR SECTION

Establishment of an Aeronautics Section in the Industrial Incentive Division of the Navy, for the purpose of stimulating production in aircraft plants and their subcontractors who are producing for the Navy, has been announced by Rear Admiral C. H. Woodward, Chief of the Division.

This section will cooperate with labor and management and War Production Drive Labor-Management Committees, in seeking to meet the necessary production schedules on which present and future combined military operational strategy is based.

At the present time there are 2,100,000 workers in aircraft plants whose total output this year will be $20,000,000,000 in planes and aviation equipment. It is estimated at the current rate of labor turnover, nearly 1,700,000 new workers will have to be recruited for the aircraft industry in order to obtain the necessary 500,000 new workers next year. Working closely with the Bureau of Aeronautics, the section will seek to impress management and aircraft workers with the importance of their work, and their vital rôle in the war effort. It will not concern itself with production problems as such, but only with the human factors involved.

"Experience of this Division has proved conclusively that when workers and management have a better understanding of their importance to, and rôle in, the war effort, speed and quality of production are stepped up," Admiral Woodward said. "Intelligent and progressive management and labor have found that concrete results come from taking human factors into account."

AVAILABILITY OF PLASTIC RAW MATERIALS

Benzol and Phenol.—The average processor who uses resins and powders is not particularly concerned about the availability of such things as benzol and cresol until he knows how they affect his supply of phenolic molding powder. It is well known that a great portion of the phenolic raw materials are obtained from coal tars. When coal is changed into coke a volatile substance known as coal tar is given off, and this substance which is captured by product coke ovens serves as the base for such things as benzol, cresol, zylol, etc. Benzol (technically, benzene) is one of the most important of these coke by-products and is the chief source of phenol or carbolic acid. There is a small amount of natural phenol produced from the original coking process, but by far the greatest part—synthetic phenol—is obtained from benzol. They are virtually interchangeable in the manufacture of phenolic resins.

But benzol is useful for many other purposes than the manufacture of phenol. It is widely used as a solvent and in aviation gasoline, aniline, intermediate dyes, styrene and other chemical products. Therefore, the demand for it is stupendous. Furthermore there is not much possibility of increasing facilities for no one is going to make much more coke than can be consumed in steel production, just for the sake of getting more benzol.

When loose talk gets around that benzol is tight but phenol is plentiful, it is just silly prattle. At the present time there is sufficient phenol for military purposes and for all important industrial and civilian items, but there is no telling when a sudden military demand may require great additional quantities. Nor is there any telling how much benzol may be allocated to phenol manufacture in 1944. (*Please turn to page 170*)

Cloud Service DE LUXE

◆ One of a series of "Blue-Prints For Tomorrow" by Egmont Arens, Industrial Designer

After the war, the tempo of global flight will call forth products of service and convenience that will soar to new heights of ingenuity and inventiveness.

This aeroplane tray designed by Egmont Arens is just one of the myriad of such bold new things in which plastics will be called to play a most significant part. And Columbia plans to be fully prepared when peace returns, to custom-mold these plastics for manufacturers who are today looking ahead. That is why Columbia has its own "Blueprint for Tomorrow" . . . the building of an injection molding super-plant that will set new production standards for the plastics industry.

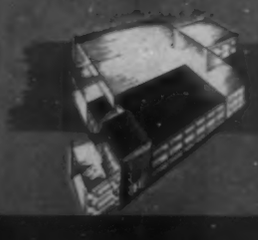
BUT TODAY, Columbia's facilities for molding are devoted to the war effort. Prime or secondary contractors on war or other essential products will find us whole-heartedly cooperative to the extent of available capacity. If you have an essential plastics problem, call or write Columbia.

Aeroplane Tray for Global Airways

Tray is designed for full-course meal. Neatly recessed areas for bread and butter, vegetables, salad, condiments and, of course, dessert — eliminate need of plates and side dishes.

Indented spaces accommodate knives, forks, spoons and napkin. Drinking glass, coffee cup, sugar, creamer and salt and pepper shakers nestle firmly into receptacles, and won't tip no matter how bumpy the flight.

Trays are made to stack easily in minimum space, after washing. Underneath the tray are small folding legs which when extended, permit stacking for economical handling, so that food may be put on the trays in the ground cafeteria. Trays are then stacked and put into a carry-box for easy handling by plane hostess.



COLUMBIA

PROTEKTOSITE CO., Inc. Carlstadt, N. J.

cp custom plastics

IN THE NEWS

★ LATE IN NOVEMBER, NORTH AMERICAN PHILIPS Co., Inc., will move its commercial and administrative departments to Pershing Square Building, Park Ave. at 42nd St., New York City. The change will not affect production personnel at Dobbs Ferry, N. Y., Mount Vernon, N. Y., and Lewiston, Maine. The Purchasing Dept. will remain at Dobbs Ferry.

DR. W. D. TURNER

★ ANNOUNCEMENT HAS BEEN MADE OF THE ADDITION of Dr. W. D. Turner to the New York staff of Plastics Industries Technical Institute. Dr. Turner who has been active in the plastics industry since his appointment in 1927 to the Bakelite Fellowship at Columbia University, obtained his Ph.D. in chemistry at the University of Chicago. After 10 years as professor and head of the Department of Chemistry at the University of Missouri, School of Mines and Metallurgy, Dr. Turner joined the Department of Chemical Engineering, Columbia University. He will handle the technical and research consultations of the Institute within the Eastern Division.

★ THE NAVY HAS COMMENDED THE PLASTICS DIV. of Celanese Corp. of America, New York, N. Y., for its development of red and green Lumarith sheeting for use in the blind flying training program.

★ THE ADVISORY COMMITTEE OF ULTIMATE CONsumer goods of American Standards Association has been expanded to include representatives of national manufacturing groups, service organizations, trade associations, additional consumer and retailing bodies and labor organizations. The committee has recommended the early completion of textile test methods, definitions for consumer goods and standards for children's and women's garment sizes. It also has suggested that a postwar planning committee be appointed to investigate the commodity field as it is affected by new materials and make recommendations when the need arises for commodities made of such materials as plywood, plastic and synthetic rubber; to review standards set by the war agencies; and to review American war standards for consumer goods.

★ ERNEST A. JOHNSON HAS BEEN APPOINTED AS assistant to George W. DeBell, consulting engineer, of Stamford, Conn. Mr. Johnson formerly was project engineer at Plastic Manufacturing, Inc.

★ CARTER PRODUCTS CORP., CLEVELAND, OHIO, has announced the development of a plastic tubing for electrical insulation with one or more color stripes extruded into the body of the tubing to make easy identification possible. The color stripes in "Striatube" tubing are an integral part of the extrusion and are as permanent as the body of the tubing itself. It can be furnished in flexible or rigid form in a wide variety of sizes, lengths and thicknesses. Either opaque or transparent, the tubing can be supplied with one or more contrasting color stripes in any desired combination. "Striamold" which is produced by the same process, has decorative color stripes extruded into the body of the molding.

★ CLAY BROWN, FORMERLY VICE-PRESIDENT AND manager of the Plywood Div., Smith Wood Products, Inc., has been appointed assistant to the president of United States Plywood Corp. He will make his office at the headquarters of the corporation in New York City.

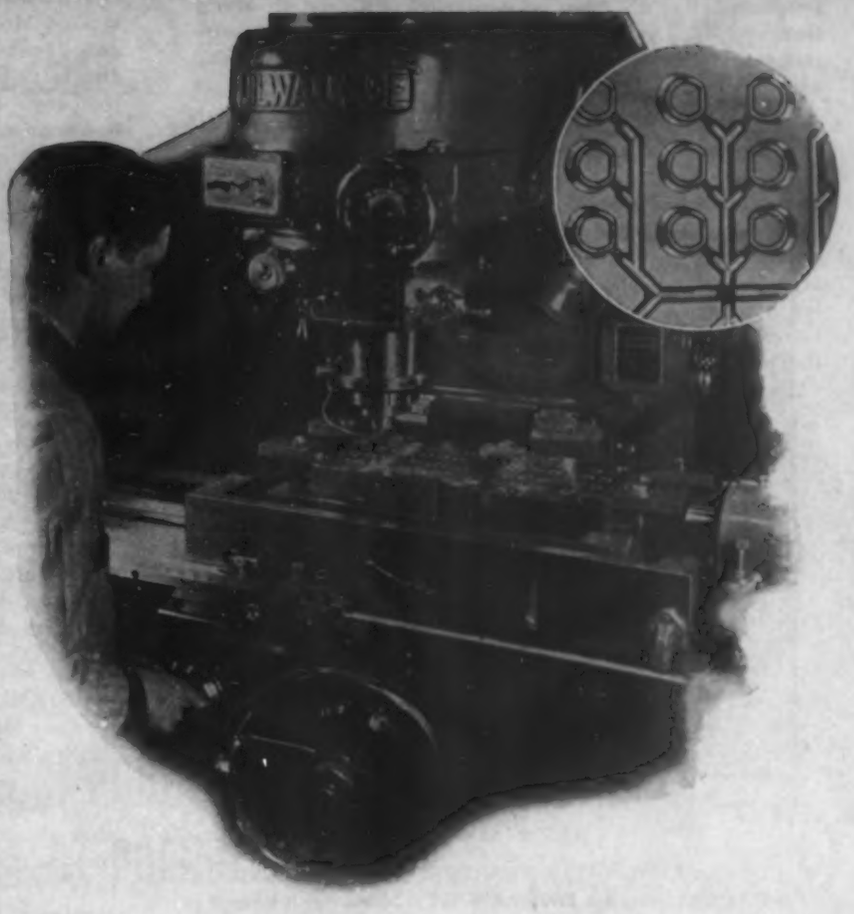
★ THE 19TH EXPOSITION OF CHEMICAL INDUSTRIES which is scheduled at Madison Square Garden, New York City, for the week beginning Dec. 6, will be highlighted by examples of modern laboratory outfitting according to present indications. Laboratory methods which are new and testing equipment that will speed war production will form part of the exhibit.

★ ACCORDING TO A DISPATCH TO THE MAGAZINE *Foreign Commerce*, particular attention has been given in India to the development of methods of plastics production. Natural resins and materials such as shellac, casein, oilseed cakes and cellulose wastes are plentiful. Plastics have been produced from coffee beans, oilseed cakes, bagasse, jute waste and horn waste. Several types of resins have been evolved starting with vegetable oils. Tests on a pilot plant have established the fact that formaldehyde can be produced by the oxidation of methanol which is available in India.

F. H. CARMAN

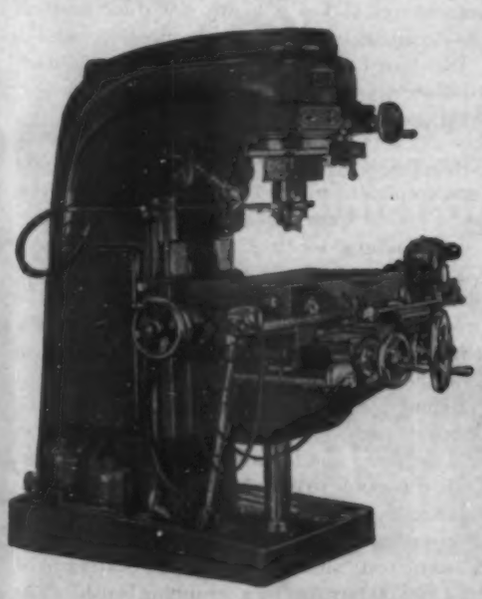
★ FRANK H. CARMAN WILL ASSUME THE POSITION of general manager of Plastics Materials Manufacturers' Association, Washington, D. C., effective January 1, 1944. Since 1941, Mr. Carman has been with WPB in Washington. Originally appointed to handle the allocation of neoprene, he was responsible for allocations of all synthetic rubbers and vinyl polymers until Aug. 1943. During this time Mr. Carman devoted considerable time to his work as technical consultant for Chemicals & Allied Products Branch, working with the Coordinator for Rubber of WPB and the Rubber Reserve Co. Prior to the appointment of the Rubber Director he handled all details connected with the synthetic rubber program for WPB. In Aug. 1942 Mr. Carman was appointed Chief of Plastics Section in the Chemicals Division with responsibility for allocations, plant expansions, priority assistance, manpower problems, etc., for thermoplastic, thermosetting and vinyl resins, adhesives and acrylo-nitrile which is used in the production of synthetic rubber. Prior to his Washington affiliation Mr. Carman was with Armstrong Cork Co., and before that, with B. F. Goodrich Co. (*Please turn to next page*)

24 CAVITY MOLD FINISHED IN *18* HOURS!



Estimated time required by other methods was more than 100 hours!

THE two halves of the 24 cavity mold were aligned and properly spaced on the Milwaukee Rotary-Head Milling Machine table. The first milling operation was performed on the first cavity in the back row. Then, by moving the table the proper distance — the same operation was performed on the next cavity. Since the cavities in the two mold halves were identical, this and succeeding operations were simply carried over to the opposite half of the mold. Each operation was readily performed in proper sequence and the entire 48 impressions of the 24 cavity mold were machined completely at a single set-up in 18 hours.



KEARNEY & TRECKER'S ROTARY HEAD MILLER

The Most Versatile Machine Ever Designed for Mold and Die Work

DIRECT . . . mills mold cavities in a single set-up without the aid of templets or models.

ACCURATE . . . chances for error are eliminated because there is no change in set-up. Exact control of all combinations of cutting movements—possible only with this machine—transmits mathematical precision to the work.

FAST . . . initial job preparation and set-up time is reduced to the minimum. Accurate performance of the machine saves operator's time and rapid production of intricate molds and dies is the result.

•

Write for Bulletin No. 1002C for complete information on the Milwaukee Rotary-Head Miller and the accurate and rapid production of all types of molds and dies for plastics.

•

Rotary Head Milling Machine

•

Autometric Jig Borers

•

Center Scope

Kearney & Trecker Products

CORPORATION

Milwaukee, Wisconsin

Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder

•

Milwaukee Midgetmill

•

Milwaukee Speedmill

★ WITH A VIEW TO CREATING AND PROMOTING A greater interest in plastics, its future progress and development, the Cleveland Plastics Research Assoc., has been organized. Graduate students of plastics schools and persons engaged in commercial plastics industries are invited to attend the meetings which are held every second Monday at 8 p.m. at 1611 E. 21st St., Cleveland, Ohio. Newly elected officers are Jack Rodda, president; Ray C. Alten, vice-president; Roland C. Marcy, treasurer, Winfred P. Rupprecht, secretary; W. S. Mead, entertainment; J. B. Wolf, program; Elmer J. Speltz, membership, and Joseph A. Lechner, publicity.

★ A CHART LISTING A SERIES OF NEW PLASTICIZERS and softeners now being produced commercially for use in coatings, ahesives, plastics, cellulose esters and ethers, synthetic resins and synthetic rubbers can be obtained from the manufacturer, Glyco Products Co., Inc., Brooklyn, N. Y. The plasticizers, which consist of alkyl and alkyl ether esters of higher fatty acids and dicarboxylic acids, are said to be characterized by their low freezing points and very mild odors. The chart gives the following physical properties: specific gravity, color, solidification point, acid value, solubility, boiling point and compatibility.

JAS. H. SAVAGE

★ JAS. H. SAVAGE HAS RESIGNED AS PLASTICS CONsultant to Conservation Division of WPB to establish himself in private practice at 72 Fifth Ave., New York City. Mr. Savage will give the same type of "end product" advice and guidance that gained for him such an excellent reputation during his stay in Washington which followed 15 years' experience in the industry. Through his work with the Conservation Div., Mr. Savage has an excellent picture of the part that plastic materials are playing in the war effort and their relative position to other materials in the overall postwar thinking. In addition to his plastics advisory service, he plans to be of assistance to industry in its various governmental problems. "While not in any sense offering any 'favors' or 'insides'," Mr. Savage said, "I do feel that war production could quite definitely be expedited if industry had a better understanding of governmental regulations and needs." He further states that he is currently available to render Washington service to business men with problems in the nation's capital. In addition to his wide American acquaintance, Mr. Savage has many friends in the Canadian industry and has been widely quoted in the Canadian and British press.

★ TIMKEN ROLLER BEARING CO., CANTON, OHIO, has announced the appointment of Whitley B. Moore as director of sales for all divisions including industrial, automotive, railroad, service-sales, steel and tube, and rock bit. C. H. McCollam will succeed Mr. Moore as general manager of sales of the Steel and Tube Division.

★ A JOINT MEETING OF THE SOCIETY FOR EXPERImental Stress Analysis and the Applied Mechanics Division of American Society of Mechanical Engineers will be held on Dec. 2 through 4 at Hotel Pennsylvania, New York City. Inquiries should be addressed to Society for Experimental Stress Analysis, P. O. Box 168, Cambridge 39, Mass.

★ AFTER A TENURE OF SERVICE IN THE ARMY, Raymond R. Dickey, former editor of MODERN PLASTICS magazine, has become manager of Plastics Div., Monroe Auto Equipment Co., Monroe, Mich., manufacturers of metal plating and plastics materials.

★ DRACKETT CO., CINCINNATI, OHIO, HAS ACquired a major part of the laboratory and pilot plant equipment of Ford Motor Co. Mr. Boyer who headed the Ford research on soy beans, has been appointed director of scientific research for Drackett Co., and several of his technicians also have joined the company. Roger Drackett, formerly assistant to the president, has been made executive vice-president; A. H. Boylan, sales promotion manager, becomes vice-president of advertising and marketing research; K. H. Jones in addition to acting as secretary will be assistant treasurer. Other officers are Mr. Drackett, president; James J. Heekin, vice-president; A. E. Heekin, treasurer; H. G. Helfrey, assistant secretary; Donald Spice, chemical director; and Dr. W. C Gangloff, scientific consultant.

★ BUILT-IN COLOR IS TURNING MORE AND MORE manufacturers of home and office furniture and equipment toward more varied use of plastics as they project designs for postwar products, according to a recent report by Plastics Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Finishing is one of the most costly items of manufacture in this line of products. Built-in color, the report pointed out, means freedom from chipping—a tremendous advantage over other structural materials which must be treated with costly finishing processes. Plastics are suggested as a means of overcoming defects of metal file and desk handles which are attacked and dulled by perspiration from the hands. Plastics also are mentioned for legs, trim, hardware, seat coverings for furniture and for use on refrigerators.

★ CHEMICAL ENGINEERS AT UNITED STATES RUBber Co.'s Mishawaka, Ind., plant have developed a plastic board which already is in wide war use and is being perfected for application in the postwar home. In addition to being very light—only half the weight of aluminum—the board's tensile strength and ability to withstand strains compare favorably with the best metal alloys with relation to weight, according to company engineers. The plastic board also is a non-conductor of electricity, will stand excessive vibration and is not affected by gasoline, oils, aromatic blends of fuels, acids, most alkalis, alcohol and other solvents. The fact that it retains its properties over a wide range of temperatures makes it highly useful for wartime needs. In addition it can be bent, cut and formed into almost limitless shapes. This board now is the principal material used to support bullet-sealing fuel cells in airplanes, and many de-icer tanks are made of this material.

★ GARNETS ARE BEING USED BY THE NAVY TO cover decks and gun emplacements of our ships. The garnets, pulverized into coarse grains, form part of a new deck covering, called "Dektred," manufactured for the U. S. Navy by Goodyear Tire & Rubber Co., Akron, Ohio. It is made by mixing the ground garnets with a special synthetic resin binder that has the ability to stick to a smooth steel surface. Dektred applied with a trowel or sprayed from an ordinary spray gun, is intended to prevent slipping. In the development of this product 2 problems had to be solved: to find a synthetic resin binder which could be applied easily and which had sufficient strength and texture to hold on smooth steel surfaces; and to find abrasive particles that were satisfactory. It is possible to use alundum, a product made by fusing aluminum oxide in an electric furnace, instead of garnets. Tests show that the covering can stand forces up to 7000 p.s.i. and remain intact. A "scrub test" showed the Dektred coating to be as good as new after 1,000,000 strokes by a scrubbing brush. The film thickness is approximately 10 times that of an ordinary paint film; and the covering is said to be remarkably fire-resistant. Resistant to both heat and cold, the Dektred dries quickly. Standard colors are battleship gray, Navy blue, terra cotta, green and olive drab.

(Please turn to next page)

The Real Sensation in Plastics

the only proved successful phenolic replacement compound

Makalot's K.E.M.—developed to replace critical Phenolics—is the outstanding achievement in Plastic Research in recent years.

For both War jobs and essential uses, K.E.M. provides a new compound that LOOKS like Phenolics, MOLDS like Phenolics, has similar properties and generally will give comparable results.

K.E.M. "as-is," or with 15% Phenol, gives the molder just what he needs at this time. The tremendous savings in Phenol and Formaldehyde must be released for the more critical war and essential uses.

REMEMBER: Investigate K.E.M. for WHATEVER YOU MOLD!

K.E.M.

KEEP 'EM MOLDING

THE HONOR ROLL OF USES!

Closures
Display Trays
Electrical Parts
Containers
Stove Handles
Castors
Calendar Pads
Dispensers
Wall Plates
Buttons
Watch Cases
Soap Boxes
Cups and Cup Holders
and
Many other articles for Army, Navy and Civilian Uses.

FOR WAR WORK'S CRITICAL COMPOUNDS

Investigate THESE MAKALOT PHENOLICS

#1040 Best molding Low Loss compound available. High Arc Resistance.

#1163 General purpose. Unsurpassed in molding and final qualities.

#93C Fabric filled, super-impact with flowing and molding qualities equal to most wood-filled compounds.

#1962 Supreme for 7 years for molding around inserts. "NEVER CRACKS."

Many other MAKALOT Phenolics are available for Critical War Uses.

PHENOLIC RESINS · MOLDING COMPOUNDS · FABRIC & PAPER IMPREGNATING RESINS · UREA RESINS & ADHESIVES · PHENOLIC LACQUERS · VARNISHES

"KEEP 'EM MOLDING"

Makalot

CORPORATION

262 WASHINGTON ST., BOSTON 9, MASS.

Central States Representative: C. R. Olsen, 1020 15th St., Rockford, Ill.

Pacific Coast Representative: Milton Turk, 1425 S. Flower St., Los Angeles 15, Calif.

The Independent Producer of Superior Plastics

★ PLASTICS ENGINEERS ASSOCIATION HAD AS ITS guest speakers at the meeting held on Oct. 18 at the Yale Club in New York City, John H. Smith, sales manager, Plastics Div., William L. Marshall, Ltd., and G. N. Oslund, tool supervisor, Plastics Dept., General Electric Co. Mr. Smith stated that his organization has been doing experimental work on the production of plastic-bonded plywood tubing for the past 8 months in cooperation with General Electric Co. The tubes now are being produced on standard convolute machines like those regularly used to produce paper tubing. A high rate of production and desired characteristics in the finished piece are attributed, he said, to the preassembly of veneers through the use of hand-fed machines. These allow rapid alignment of the veneers for maximum strength and other desired properties. Mr. Oslund described the various basic types of compression molds and discussed many problems and limitations involved in their use.

J. C. KAZIMIER

★ J. C. KAZIMIER HAS BEEN APPOINTED CHIEF ENGINeer of the Plastic Div., Amos Molded Plastics, Edinburgh, Ind. For the past 12 years Mr. Kazimier was associated with Chicago Molded Products as development engineer.

★ RUBBER AND PLASTICS GROUP OF AMERICAN SOciety of Mechanical Engineers has arranged for 8 sessions of papers and discussions at the annual meeting of the Society on Dec. 1 and 2 at the Hotel Pennsylvania, New York City. The papers schedules for the meetings are as follows: Dec. 1, joint session with Aviation Div.—"Current Applications and Future Possibilities of Paper-Base Laminates in Aircraft" by Charles F. Marschner, McDonnell Aircraft Corp.; "Plastic Tubing and Fittings" by William M. White, Douglas Aircraft Co., Inc.; and "Behavior of Synthetic Urea-Resins Assembly Adhesives under Alternating Stresses" by Albert H. Dietz, Massachusettes Institute of Technology, and Henry Grinsfelder, Resinous Products and Chemical Co. Dec. 2, morning Plastics session—"Creep Properties of Molded Phenolic Plastics" by David Telfair, T. S. Carswell and H. K. Nason, Plastics Div., Monstanto Chemical Co.; "Plastic Printing Plates" by William R. McLain; and "Anti-Scatter Treatments for Glass" by Frank W. Reinhart, Ruth Kronstadt and Gordon M. Kline, National Bureau of Standards. Dec. 2, afternoon Rubber Session—"Inflatable Life-Saving Rafts in the War Effort" by J. G. Kreyer, Firestone Tire and Rubber Co.; "Use of Rubber in Power Drive Lines" by James N. Booth, Thompson Products Co.; and "Advances in Rubber and Plastics during 1943"—the rubber section by W. J. Liska, Firestone Tire and Rubber Co., and the plastics by G. M. Kline, National Bureau of Standards.

★ THE CHEMICAL INDUSTRY MEDAL OF THE SOciety of Chemical Industry will be presented to Dr. John J. Grebe, director, Physical Research Laboratory, Dow Chemical Co., Midland, Mich., at a joint Meeting on Nov. 12 of American Section of Society of Chemical Industry, New York Section of American Chemical Society and New York Section of American Institute of Chemical Engineers. The medal is awarded for valuable applications of chemical research to industry.

Speeches of the month

★ VINYLITE PLASTICS WERE THE SUBJECT OF THE address given by J. R. Price of Carbide and Carbon Chemicals Corp., before the Plastics Club of America at its Oct. 19 meeting at the Hotel Pennsylvania, New York City. After defining the basic raw materials from which vinyl resins are made, Mr. Price discussed the many forms, which plastics, made from these powders, can take—rigid molded plastic, simple flat sheets, plasticized sheeting and flexible molded products. He described at length the many interesting war applications of the elastic form of vinyl resins and mentioned numerous uses of vinylite plasticized sheeting. Turning to postwar possibilities, Mr. Price discussed potential uses of this plastic in the automotive industry, in architecture, packaging, commercial fishing, metal finishing, in the shoe industry and for home furnishings. He emphasized the importance of gaining a more complete knowledge of plastics in order to assure their future success.

★ THREE SPEECHES ON PLASTICS WERE FEATURED at the fourth Mid-American Chemurgic Conference held in Cincinnati, Ohio, on Sept. 30. "Plastics in the metal industry" which was presented by Dr. Anson Hayes and George R. Hoover of American Rolling Mill Co., dealt with the application of plastics in the metals industry by comparing the uses and properties of plastics, steel and aluminum alloys—some favorable comparisons and some less favorable. Dr. W. C. Gangloff, chemical director of Drackett Co., discussed "Plastic Fillers." After giving a brief explanation of the term "filler" Dr. Gangloff sketched the more important fillers employed in the plastics industry. These included wood flour, cotton, rag, ramie fibers, chips, excelsior and sawdust, vegetable proteins, animal hair, redwood, sisal and ramie, asbestos, mica, silica, talc, barium sulfate, titanium oxide, zinc oxide, bagasse, walnut shell and graphite fillers. The third address, "Plastics from Farm Waste," was presented by R. B. Gale, general sales manager, Idaho Power Co.

★ "PLASTICS—AT THE FIGHTING FRONT—AND IN the future" was the subject of the speech delivered by J. R. Turnbull, director of product research, Plastics Div., Monsanto Chemical Co., before the Washington, D. C., Association of Purchasing Agents on October 12. Following a brief description of the various types of plastics, Mr. Turnbull turned to the present wartime applications of these materials and to the supply situation. In addition to mentioning the contributions of phenolic resins to the war effort, he discussed the rôle of lacquers, finishes and plywood. Summing up the future of plastics Mr. Turnbull stated that in the future the tonnage of plastics available to American industry will be greatly increased as will the number of types of plastics of commercial importance. Further, the prices of plastic raw materials undoubtedly will be lower, and there will be a considerable expansion of plastics conversion facilities in the form of molding extrusion and extrusion plants.

★ "LOW PRESSURE LAMINATING" WAS THE SUBJECT of the address given by J. H. DuBois, commercial engineer, Plastics Dept., General Electric Co., before the Society of Plastics Engineers meeting in Chicago on Oct. 12. After summarizing the difference between high and low pressure laminating, Mr. DuBois discussed the problems that must be met when the latter method is employed. A description of various adhesives and lamination materials was followed by details on pressing plywood sheets, impregnated and compressed wood and flexible bag laminating.

★ DR. WILLIAM D. TURNER, PROFESSOR OF CHEMIcal engineering at Columbia University, addressed the Oct. 11 meeting of Plastics Institute Alumni Assoc., held at the Engineers Building, New York City, on the subject of synthetic rubber. Giving a history of the synthetic rubber program, Dr. Turner estimated production of synthetic rubber for 1944 at 835,000 tons compared to a peacetime production of natural rubber of 800,000 tons per year. He illustrated and (*Please turn to page 172*)

Our fighting aircraft find extensive use for parts made of both National Vulcanized Fibre and Phenolite, laminated Bakelite. These materials possess unusual lightness in weight, great dielectric strength, and exceptional wearing qualities.

GOING TO WORK

HURRYING "upstairs" to take on the japs "coming down the alley" is the way our boys in the Pacific are going to work. There're no time clocks or 8-hour days for them. It's full time all the time. And when we read "X number of our planes failed to return," it should blast all complacency from us. It should wake us up to the fact that more sweat in work, more blood to the Red Cross, more money in War Bonds are the least we can give to save vital time—to make their sacrifices less.

NATIONAL VULCANIZED FIBRE CO.

WILMINGTON DELAWARE

Offices in Principal Cities

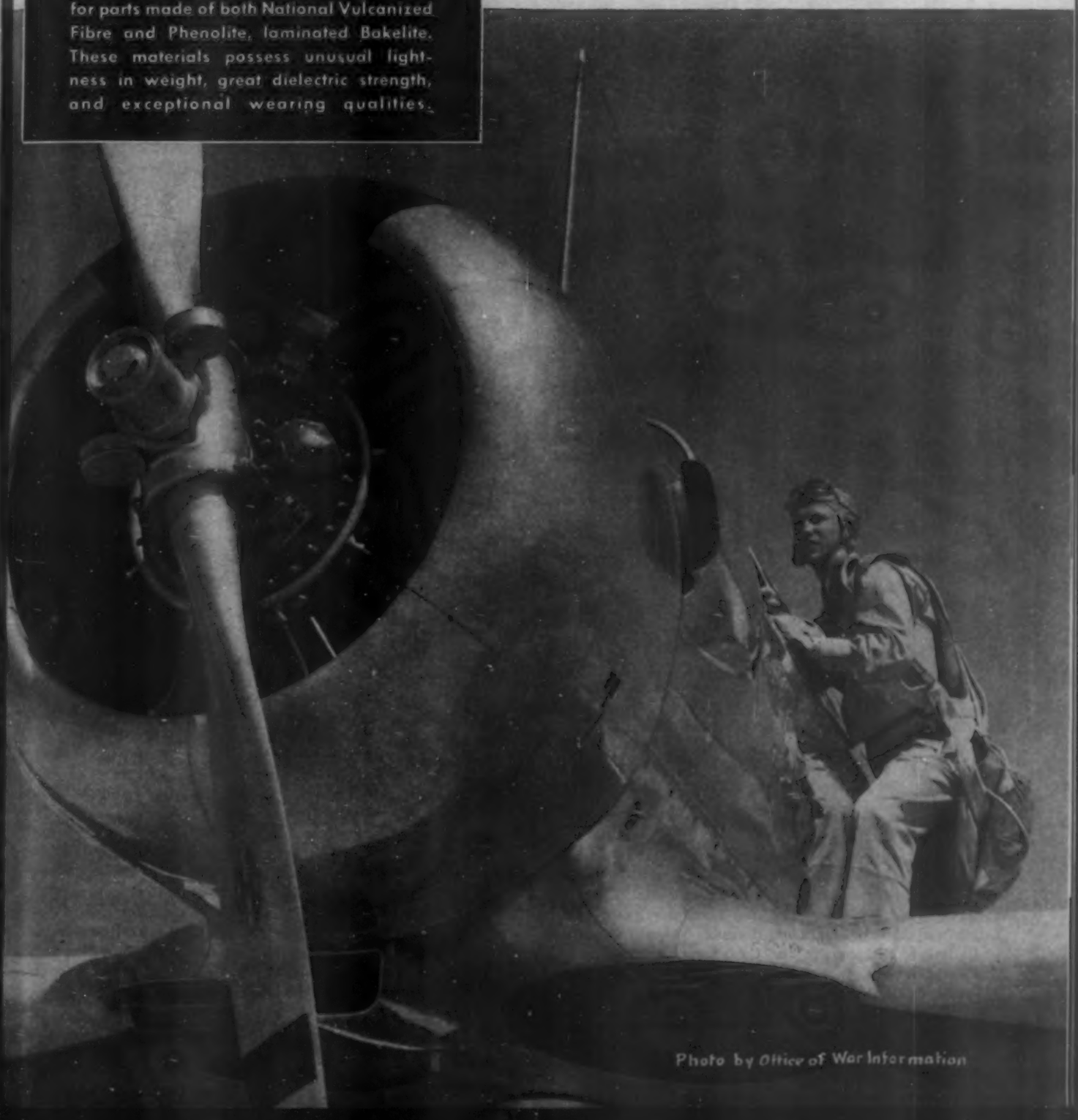


Photo by Office of War Information

Society of The Plastics Industry

The fourth in a series of monthly meetings sponsored by the New York Chapter of SPI was held on Oct. 14 at the Waldorf-Astoria Hotel, New York City. Joseph M. Schappert of National Metal Trades Association addressed the group on "Management and the Foreman," drawing his material from years of practical experience in the development of better relations between labor and management. In pointing out the need for better relations in business organizations and for doing everything practical in that direction, Mr. Schappert stressed the importance of the foreman. In his opinion, many managements do not recognize the importance of the foreman as their contact with labor. In conclusion Mr. Schappert outlined the proven ways and means of successfully attacking this problem. Due to the success of these monthly meetings, plans are underway for their continuance.

• • •

The work of the SPI Technical Committee is being organized very rapidly. "Cementing and Assembly of Molded Plastic Parts" has been added to the 10 already existing chapters which will go to make up the technical plastics handbook. The Technical Committee met on Oct. 5 at the Waldorf-Astoria Hotel, New York City, to correlate further the work of the various subcommittees. Members of this central committee are: W. J. McCortney, general chairman, and N. J. Rakas, alternate chairman, both of Chrysler Corp.; F. W. Warner, vice-chairman, General Electric Co.; Dr. G. M. Kuettel, E. I. du Pont de Nemours & Co., Inc.; R. A. Berg, Tech-Art Plastics Co.; and R. E. Dodd, Durez Plastics & Chemicals, Inc.

• •

A series of meetings of the Postwar Planning Committee headed by Chairman Charles Livingston, has just drawn to a close. The subject under discussion was a program for postwar applications of plastics to be presented in a closed meeting at the SPI Fall Convention.

• • •

A 2-day meeting of the SPI Engineering Classification Sub-Committee took place on Oct. 4 and 5 in the Waldorf-Astoria Hotel, New York City, under the direction of its chairman, N. J. Rakas. The work of this committee is mainly the formation of a classification of rigid plastics materials based on engineering properties. The final form of this classification will be made into a chapter in a plastics handbook. A tangible program was agreed upon at this meeting and it promises to result in a classification that will be of invaluable aid to individuals in the plastics field.

• • •

An important meeting of the SPI Pacific Coast Section was held on Sept. 22 at the Biltmore Hotel in Los Angeles. Morris Ullman, Chief of the Industrial Materials and Equipment Section, Los Angeles District of OPA, spoke on "Price Regulations Affecting the Plastics Industry." Other addresses were presented by R. W. Jewell, Senior Economist, National War Labor Board, who spoke on "The Wage Stabilization Program;" and Dr. Vernon D. Keeler, author and lecturer, who talked on "Industry Wide Job Descriptions and Evaluations for Plastics Manufacturers."

• • •

The Fall meeting of the Canadian Section of SPI was held in the Royal York Hotel, Toronto, on Sept. 23. About 107 members and guests were present to hear George K. Scribner, president of the SPI, outline the growth and development of the society from an era of isolation to an era of cooperation and unity. A. R. Byrne, chairman of the Canadian Section, introduced Mr. Scribner, Wm. T. Cruse, executive vice-president of SPI, and James Neal, Norton Laboratories.

In a 45-minute talk highlighted with humorous references to early attempts to organize the plastics industry, Mr. Scribner traced the early history of plastics and phenolic molding in the United States. Mutual distrust and individual initiative kept the pioneer plastics concerns apart for almost 2 decades, he recalled. Finally in 1935 the first real get-acquainted session of the leading plastics concerns set the stage for the eventual formation of the SPI. Mr. Scribner said that 1935 saw a new "material" age develop for the industry—the advancement of cellulose acetate and other new product materials. With the outbreak of war in Europe the industry entered the "serious" era and tremendous education in the application of plastics has resulted. He cautioned his Canadian audience against withholding technological facts and information concerning their production methods from the industry. "Tell the rest of the gang," he suggested. Mr. Scribner described the post-war planning program in the U. S. and its anticipated effect upon the plastics industry. The plastics industry needs a sound public relations job done on its behalf, he asserted, if plastics are to achieve full recognition of the consumer in post-war buying.

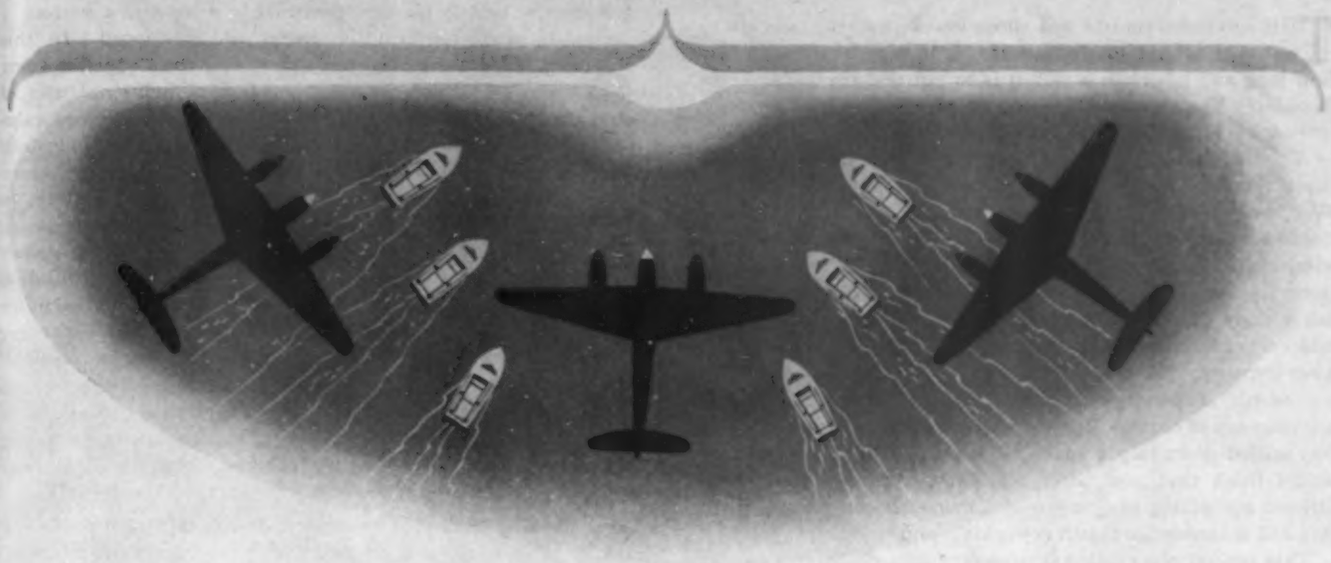
William T. Cruse said he was impressed by the Canadian production facilities during his visit. He outlined the supply conditions in U. S. as they affect phenolic resins, urea and melamine materials, and thermoplastic materials under WPB controls. Shortages of thermoplastic materials had resulted from intensive overstocking by molders and distributors, he stated, resulting in a regulation limiting material supplies to 30 days' production requirements. He mentioned that SPI surveys show the present national output of powder molding materials to approximate $120,000,000. Five years ago, he said, total plastics production of this type was less than half this volume. Mr. Cruse referred briefly to the tax and labor problems, explaining the effort SPI is making to assist the industry in obtaining facts and data to support negotiations at Washington for legitimate tax remissions.

Assurance of a continued policy of equitable distribution of the available material supplies was given to the meeting by E. T. Sterne, Chemicals Controller, Department of Munitions and Supply, who stated that a harmonious working arrangement with the WPB at Washington was guaranteeing necessary stocks of materials. He commended the Technical Committee under John Dean, Duplate of Canada Ltd., for its cooperation with the National Research Council and the Dept. of Munitions and Supply. John Dean, chairman of the committee, reported a series of interviews with the National Research Council to set up a liaison group between the industry and the Department of Munitions and Supply to determine war production standards and requirements. A brief has been prepared urging M. & S. to submit any new application of plastics production to this joint committee for comment. B. F. Henden, Plastics Div., Canadian Industries Limited, Canadian member of the SPI Publicity Committee, reported his correspondence with John Sasso, chairman, and gave an outline of an industry advertising campaign under consideration in the United States to educate the public on plastics. The possibility of interesting the National Film Board of Ottawa, in producing a film in Canada on plastics was suggested. Mr. Henden also proposed consideration for the formation of a small Publicity Committee within the Canadian section and expressed his belief that a letter should be sent to the editors of all Canadian publications interested in plastics giving them news on meetings and an outline of the general activities and personalities in the Society of the Plastics Industry in the Dominion.

The report of Dr. R. V. Nichols, McGill University, chairman of the committee on plastics education, was read in his absence by Mr. Byrne. The group was told that plastics technology courses now are incorporated in the curriculum at McGill University and at the University of Toronto.

The next meeting of the Canadian section to be held at Montreal on Dec. 10 will be a joint meeting with the Rubber and Plastics Div., Society of Chemical Industry, Montreal Section. A one-day conference of the Canadian section of the SPI will be held in Toronto on January 25, when a panel of speakers for the occasion will be arranged.

PLYOPHEN



plugs a dangerous gap in the laminating field

RCI's complete new line of liquid phenolic laminating and bonding resins and varnishes is solving production headaches all over the country. For these new industrial plastics have come through the severest electrical and mechanical tests with augmented reputations—and have conclusively proved their superior worth for wood bonding and impregnation, low-pressure molding, high strength paper, fiber glass insulation, and the many applications requiring extreme water resistance.

Together with the quantity production of these important new synthetics, RCI—America's largest producer of synthetic resins—offers customers the services of its experienced research personnel, *and has recently become an important source of essential phenol.*

You are invited to write for complete information on these products and services.

RCI

WORLD-WIDE DISTRIBUTION

REICHHOLD CHEMICALS, INC.

General Offices and Main Plant, Detroit, Michigan

Other plants; Brooklyn, New York • Elizabeth, New Jersey • South San Francisco, California • Tuscaloosa, Alabama • Liverpool, England • Sydney, Australia

SYNTHETIC RESINS • INDUSTRIAL CHEMICALS • CHEMURGIC RUBBER • CHEMICAL COLORS • INDUSTRIAL PLASTICS

LONDON LETTER

THE successful control and allocation of raw materials are an essential of war production, if it is to be fully efficient—yet how long and laborious a task it is to put this particular house in order! You in America will know plenty about the immense intricacies of introducing order and system into the handling of hundreds of valuable war materials, many of them at the same time complementary or supplementary to one another. Well, over here the task has been rendered even more difficult because with our restricted resources it has been absolutely vital that there be no wastage of even a fraction of whatever materials have been available. As a result we have, from fairly early in the war (speaking generally), imposed a rather wider set of controls than perhaps has been considered necessary in your country. For some time there was deep suspicion as to the worth of what sometimes threatened to be a top-heavy bureaucracy of control departments; but at long last everything has settled down into a smoothly running production machine, and I think that now, after nearly four years of war, we in Britain are willing to give our raw materials control system its due and acknowledge that it is working, and working well.

This general observation is prompted as a result of reading a recently issued Government booklet, "The Raw Materials Guide," put out by our Ministry of Supply. It is comprehensive, yet concise, and is heartening evidence that at last the Control departments really know what they are doing, what they want to do and how they are doing it. The guide gives an idea of the nature and land of origin of commodities, the measure of control exercised, and adds a summary of Statutory Rules and Orders restricting the movements and uses of material in their chronological order, ending with the name and address of each Raw Materials Branch and its Controller.

The guide reveals that the British Ministry of Supply now has about 30 separate Controls, covering more than 60 main raw materials. What is of more particular interest, it gives some useful facts about the control of plastics, and of one or two allied or supplementary products, such as glues and gelatin. The main facts about plastics control I gave in a recent letter, but it is interesting to note from the summary how widely plastics is now in use, and how many different Government departments now have interests in various plastics materials. Thus, our Plastics Control operates special joint committees in collaboration with the Ministry of Fuel and Power (over phenol, cresol), with the Board of Trade (over imports and exports of plastics plant and machinery, etc.), and with the Ministry of Aircraft Production, Ministry of Production and with the Director of General Explosives. At the same time, the plastics Control works very closely in cooperation with the Cotton Control in regard to treatments of cotton woven fabric, cotton fibers and ground, flock and cotton linters; with the Molasses and Industrial Alcohol Control in regard to use of formaldehyde, urea, alcohols, solvents and acetone; and with the Miscellaneous Chemicals Control in regard to phthalic anhydride, nitrocellulose and lead carbonate.

Prominent among the other Controls are those covering gums, hard waxes, glues and gelatin, asbestine, liquid rosin. Britain is now importing gum for manufacturing purposes from Arabia, Sudan, India, Cyprus and Australia. Hard waxes are being brought in from South American countries, where we are getting most of our glues and gelatins (also from India). As regards asbestine, we still have to rely solely on supplies from America (New York), while liquid rosin is also being imported in fairly good quantities from America under Lease-Lend.

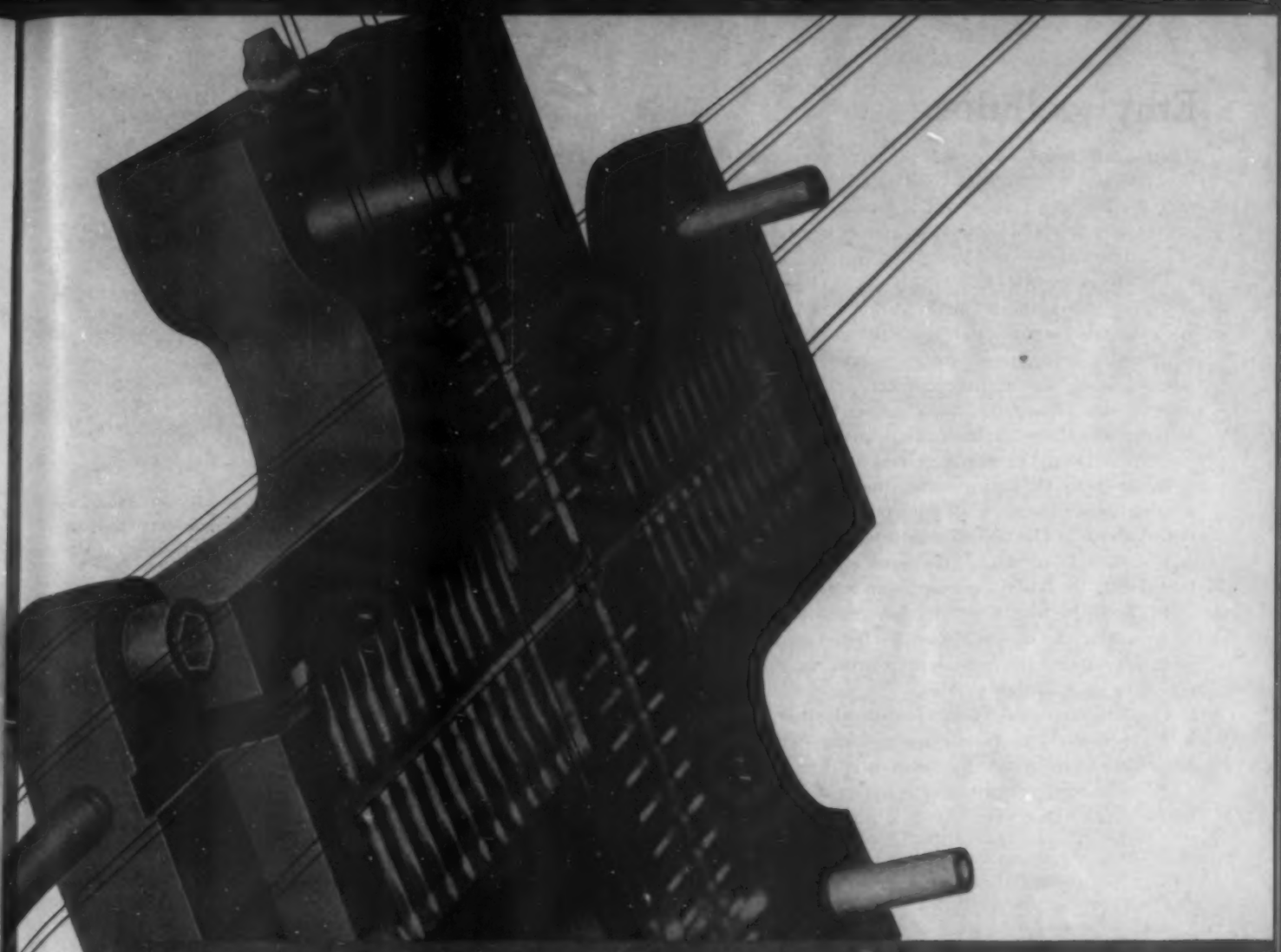
It is the raw materials side of production that continues to occupy the center of discussion in plastics circles over here, as in other trade circles, particularly in regard to the postwar era. Thus, particular attention has been paid to the announcement of the formation of a British Colonial Products Research Council, which is to investigate all possibilities of developing the British Empire's raw materials resources with an idea to new postwar markets.

It is felt that here there will be a big opportunity to extend and expand British plastics, particularly if some new sources of materials production can be found and developed. In this regard, it has already been mentioned that the Council is going in considerable detail into the question of industrial uses of sisal waste. Apart from the fact that the waste contains valuable glucosides, proteins, waxes and gums having industrial applications, it is now known that residual flash provides an excellent material for making fillers for plastics and rubbers (a process that has been developed by the African Sisal and Produce Co., Ltd., London). Another aspect of the raw materials development question is provided by the new Coal Utilization Research scheme, under which £200,000 a year is to be spent for the next 5 years, in research into usages of coal for expanding various allied industries, including plastics. Latest news of this is that the Parliamentary and Scientific Committee sponsoring the plan have urged the appointment of "several thousands" of qualified research workers, 50 percent to engage in producing liquid fuels and chemicals from coal, the remainder in developing methods of releasing and using the energy of coal.

Another interesting development is that of a photolitho synthetic albumen for use in printing. This development is attributed to F. Baradell, director of Multi Machine Plates, Ltd. The albumen is marketed under the brand name Baracoat, and is reported to give as good a result as albumen while being, in addition, much quicker to mix and less expensive. It is stated that only 4 oz. of the material are required as against 9 oz. of albumen, bringing the equivalent cost to 2*s*. 6*d*. per lb., compared with a cost of perhaps 3 times as much for albumen. Impressions are as clear and plates treated with the new material will give as long a run as plates coated with albumen. In view of the success, Multi Machine Plates have made the substitute generally available.

Another report from a similar field is that of the development of a soluble urea-formaldehyde substitute resin solution as a substitute for the egg albumen used as bookbinding glair. This has been put out by British Industrial Plastics, Ltd. Then, in the packaging field, there is news of a new material, Textuff, for use in food packaging. This is described as being germ-, odor-, taste-, grease-, dust- and dirt-proof. It is manufactured in a variety of thicknesses from prepared woven and other cloths which are saturated and embedded in a cellulose film, producing a fabric of unusual flexibility and strength, able to stand severe handling during shipping and storage. Moist and dry heats applied to 200° F. for many hours at a stretch do not weaken the tissue, and boiling fats at 360° poured in containers and allowed to set have shown no penetration for long periods. Designs can be printed on the material, and adhesives used in the ordinary wrapping trade can be satisfactorily applied (it can also be dyed and embossed). Tests with the material in the transport and cold storage of meat, butter and other foodstuffs have shown that deleterious effects usually resulting from prolonged cold storage are reduced to a minimum, while bloom and flavor are preserved.

Britain has been developing use of the new drug, penicillin (obtained from the blue-green mold, *penicillium Notatum*). It can be used directly or by injection, and prevents bacteria. The Ministry of Supply has now set up a special committee to "secure that everything possible is done to promote the most rapid development of penicillin," the committee containing representatives both of the medical and manufacturing sides. But supplies are heavily restricted at the moment. (*Mailed by Denys Val Baker.*)



INJECTION *Molding*

all materials • die making • production

On the outskirts of a thriving New Jersey community stands a new plant . . . climaxing, for its projectors, many years of plastic experience and growth . . . Built exclusively for plastics' production, its broad, one-story daylight-flooded floor areas are departmentized into . . . 1—A fully equipped, ably manned mold design and mold making division . . . 2—A battery of the newest injection presses with capacities sufficient to produce a wide range of plastic processing . . . 3—A complete hand and machine finishing room . . . 4—Expansive material storage area. In short, Sterling offers plant facilities well able to serve *today's* important and essential requirements — and an engineering background well qualified to think *tomorrow's* plans out loud with you. Inquiries cordially solicited.

STERLING PLASTICS CO.

1140 COMMERCE AVENUE

UNION, NEW JERSEY

Ethyl cellulose

(*Continued from page 103*) satisfactory. On the basis of shrinkage, measurements indicated that EC-4 and EC-5 were the best of all compositions tested by this method.

To evaluate ethyl cellulose in a more drastic test than the one outlined above, our laboratory exposed samples at 195° F. and 100 percent R. H. for 24 hours. The results, pictured in Fig. 10, show the cellulose acetate butyrate and the cellulose acetate formulas too badly distorted to measure. The ethyl cellulose compositions are satisfactory and only the softest, EC-2, was slightly distorted. These results would indicate that this plastic has a greater factor of safety when extreme conditions of high temperature and humidity are encountered than the cellulose esters tested.

Tables I to IV indicate the dimensional changes which occurred when the samples were put through the tests mentioned above. The measurements were obtained on the open end of the plastic flare. We have omitted the figures obtained after the 30-min. immersion in water at 180° F. and the 48-hr. exposure to 210° F. dry heat because of the difficulty in measuring the distorted samples noted in the photograph, and the problem of accurately measuring the small shrinkages occurring on the other moldings.

The foregoing tests prove conclusively that ethyl cellulose is a superior thermoplastic for moldings which must have minimum dimensional change at high temperature and humidities, as well as resistance to wet heat. In the ethyl cellulose plastics that were tested, it was noted that the higher

TABLE I.—TEST STANDARDS (FIG. 5)

Symbol	*Material*	*Flow symbol*	*A.S.T.M. flow value**
			° C.
CA-1	Low-acetyl cellulose acetate	MH	149
HCA-2	High-acetyl cellulose acetate	H	153
HCA-3	High-acetyl cellulose acetate	H2	157
CAB-1	Cellulose acetate butyrate	H4	165
CAB-2	Cellulose acetate butyrate	MH	149
OCAB-3	Cellulose acetate butyrate—commercial	MH	149
EC-1	Ethyl cellulose	M	145
EC-2	Ethyl cellulose	M	145
EC-3	Ethyl cellulose	H	153
EC-4	Ethyl cellulose	H2	157
EC-5	Ethyl cellulose	H	153

* Flow test in accordance with A.S.T.M. D569-41T using 1000-lb. load

TABLE II.—SHRINKAGE AFTER 3 HR. IN WATER AT 180° F. (FIG. 7)

Symbol	*Material*	*Shrinkage × 0.001 in./in.*
HAC-3	High-acetyl cellulose acetate	Too distorted to measure
CAB-1	Cellulose acetate butyrate	Too distorted to measure
CAB-3	Cellulose acetate butyrate—commercial	Too distorted to measure
EC-2	Ethyl cellulose	−13.8
EC-3	Ethyl cellulose	− 6.8
EC-4	Ethyl cellulose	− 2.3
EC-5	Ethyl cellulose	− 8.7

TABLE III.—CYCLE TEST (FIG. 9)

Symbol	*Material*	*Shrinkage × 0.001 in./in.*
CA-1	Low-acetyl cellulose acetate	Too distorted to measure
HCA-2	High-acetyl cellulose acetate	Too distorted to measure
HCA-3	High-acetyl cellulose acetate	Too distorted to measure
CAB-1	Cellulose acetate butyrate	−12.5
CAB-2	Cellulose acetate butyrate	− 3.5
OCAB-3	Cellulose acetate butyrate—commercial	Too distorted to measure
EC-1	Ethyl cellulose	− 8.3
EC-2	Ethyl cellulose	− 3.8
EC-3	Ethyl cellulose	− 2.7
EC-4	Ethyl cellulose	− 1.6
EC-5	Ethyl cellulose	− 0.8

TABLE IV.—SHRINKAGE AFTER 24 HR. AT 195° F. AND 100 PERCENT R. H. (FIG. 10)

Symbol	*Material*	*Shrinkage × 0.001 in./in.*
HCA-3	High-acetyl cellulose acetate	Too distorted to measure
CAB-1	Cellulose acetate butyrate	Too distorted to measure
OCAB-3	Cellulose acetate butyrate—commercial	Too distorted to measure
EC-2	Ethyl cellulose	−17.7
EC-3	Ethyl cellulose	− 9.9
EC-4	Ethyl cellulose	− 6.7
EC-5	Ethyl cellulose	− 7.7

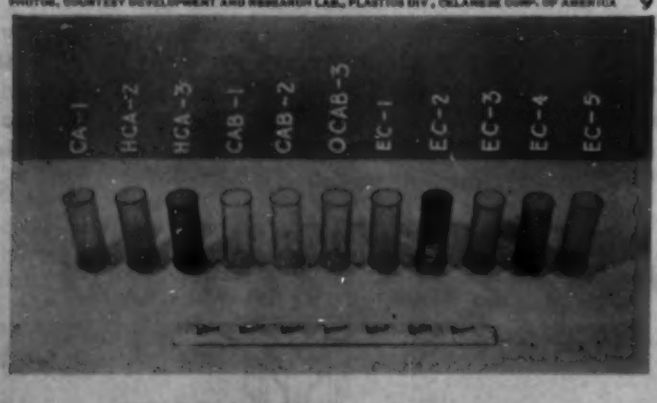
TABLE V.—IZOD IMPACT

Symbol	*Izod impact*	*Flow*	*Celanese flow symbol*
	ft.-lb./in of notch	*deg. C.*	
EC-1	7.5	145	M
EC-2	9.9	145	M
EC-3	6.9	153	H

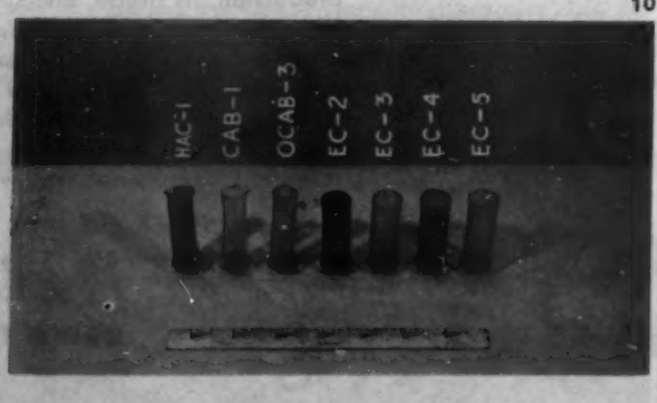
9—After this test the cellulose acetate and softer cellulose acetate butyrate parts were too distorted to measure. 10—These samples have been tested at 195°F. 100 percent R.H. for a period of 24 hours

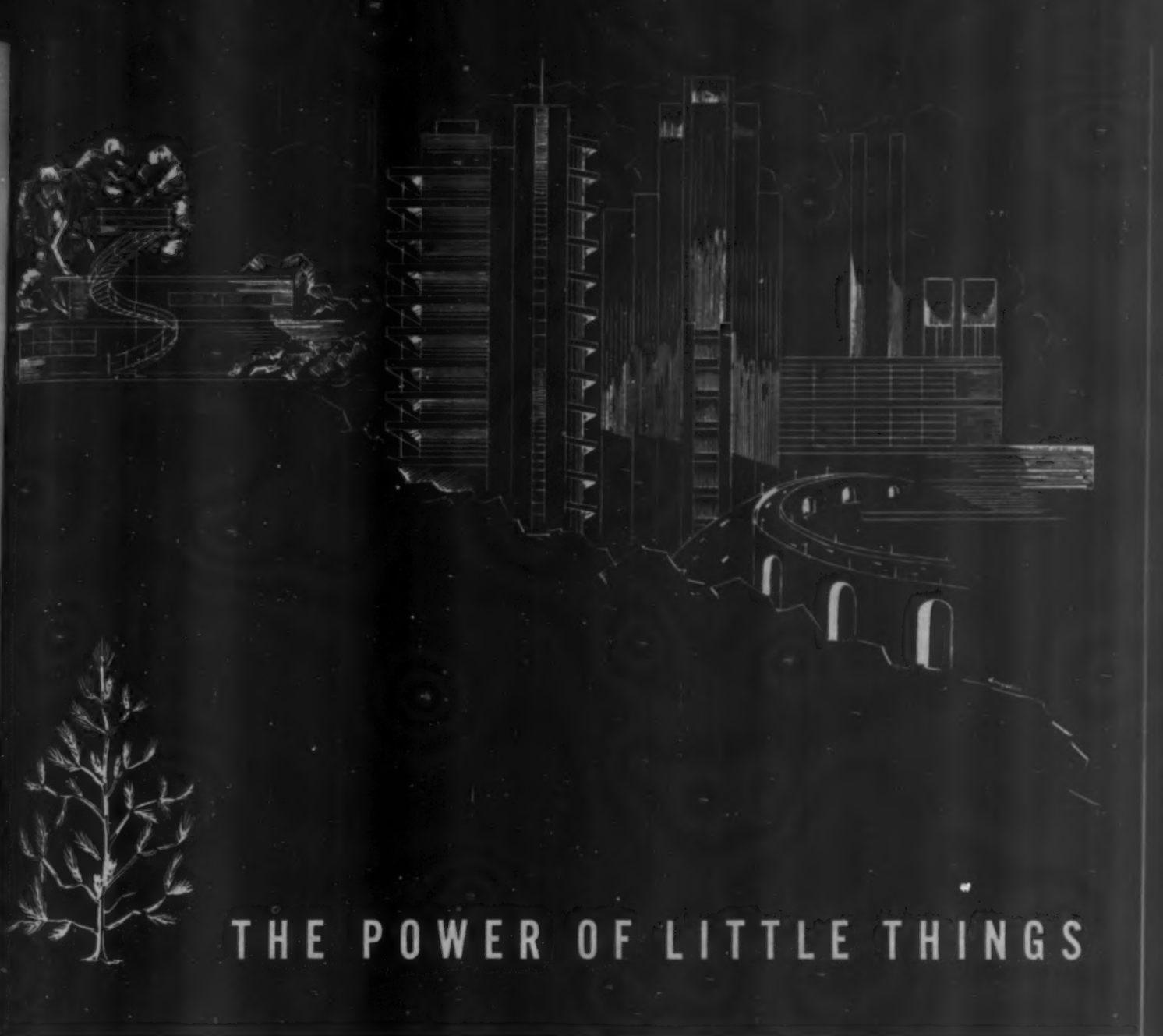
PHOTOS, COURTESY DEVELOPMENT AND RESEARCH LAB., PLASTICS DIV., CELANESE CORP. OF AMERICA

9



10





THE POWER OF LITTLE THINGS

HYDRAULICS Rodgers KEEP THE WORLD MOVING

Manufacturers of:
UNIVERSAL HYDRAULIC PRESSES
TRACK PRESS EQUIPMENT
HYDRAULIC KEEL BENDERS
HYDROSTATIC TEST UNITS
POWER TRACK WRENCHES
HYDRAULIC PLASTIC PRESSES
PORTABLE STRAIGHTENER
FOR PIPE AND KELLYS

Throughout our forest land millions of little trees have been planted to replace the nation's dwindling timber crop. In the United States over thirty billion feet of lumber are cut annually to meet our war time demands. Additional plantings on a large scale will be necessary if our critical lumber situation is to be improved.

Today a little tree has the power to grow into a giant spruce — to become a part of a new age — the plastic age of tomorrow.

Today, hundreds of moulded plastic plywood products are being successfully manufactured. Recently the Quartermaster Corps of the United States Army purchased 760,000 pairs of wood-cored rubber heels. The wood part of these heels consists of U-shaped hardwood plywood. Small holes in the wood permit the molten rubber to flow through, resulting in a secure bond. This construction saves 1¼ ounces of rubber per pair.

Tomorrow, when the war is won, and victory is assured, Rodgers Hydraulic Impression Presses will again be available. In the meantime, we are working day and night for Uncle Sam. ***If it's a Rodgers, it's the best in hydraulics.*** Rodgers Hydraulic Inc., St. Louis Park, Minneapolis, Minnesota.

Rodgers HYDRAULIC Inc.

the A.S.T.M. flow, the greater the dimensional stability.

Table V shows the Izod impact as tested in accordance with A.S.T.M. method D250–41T, for representative compositions of ethyl cellulose as evaluated for dimensional stability. The values given in this table are two to three times the impact normally obtained on other cellulose plastics. It should be pointed out that with the cellulose ester formulations it is often necessary to sacrifice dimensional stability for added impact strength or vice versa, but in ethyl cellulose these two important characteristics can be combined in one formulation to a degree never before achieved with the older materials. A most important point for the fabricator is that the desired stability and impact in the molded part can be obtained without sacrificing ease of molding.

Conclusions

It is evident from the field experience and laboratory tests that ethyl cellulose will add immeasurably to the reputation for versatility now attributed to the cellulosic thermoplastics. The imagination of the designer will formulate post-war applications for plastics once thought impossible of attainment. That ethyl cellulose plastics will be prime material for automotive and builders' hardware seems to be a foregone conclusion. Some familiar articles that come to mind as excellent applications for ethyl cellulose plastics are toothbrush handles, television radio and clock housings, refrigerator parts, vacuum cleaner housings and handles.

Rubber coated fabrics

(*Continued from page 91*) similar to those made with rubber namely: single-coated, double-coated and double-texture types. The same fabrics also were used—cotton, rayon and in a few instances, nylon. So far the discussion has covered the various manufacturing problems and activities in the making of the coated fabrics. It might be well to mention some of the articles which have been made from these fabrics and to indicate the type of coated materials that are most adaptable to specific products.

Uses for coated fabrics

First, there is the protective type of product—raincoats and other garments, sleeping bags, instrument covers, gun bloomers, gas protection fabrics and gas masks. In general we would say that this particular group of products can be made with any of the coated fabrics discussed above. No crude rubber is necessary. In fact, in most of the uses mentioned, not even synthetic rubbers are necessary. Polyvinyl butyral, vinyl chloride and its copolymers, and the alkyd resins should be satisfactory.

The next important group are those products which are used for life-saving equipment such as life rafts, life vests, diving suits and the like. In some cases, as in the case of life rafts, it has been recommended that rubber still be used for the purpose but that rubber reclaim be incorporated in part as a replacement so that the total amount of crude rubber required will be somewhat reduced. No one is ready to recommend another material particularly in view of some of the spectacular rescues that have been effected during the past 6 months. Consequently, rubber-coated fabrics still are being used for these purposes. This is an important group of items both from the standpoint of relation to the war effort and from the standpoint of volume of rubber consumed. Therefore it will require a considerable amount of concentrated attention in the immediate future.

There are other types of pneumatic equipment which still are being made of rubber-coated fabrics. These include pontoons which are used in large volume by the Engineer Corps, flotation bladders, and air mattresses. The latter item has been made successfully with polyvinyl butyral. While this equipment is not perhaps in the same important class as the life-saving items, it must hold air. Therefore the replacement work has been proceeding with great caution. Care must be taken that the items will give adequate service and not fail at some critical time in their use. It is believed that butyl rubber, polyvinyl butyral, Neoprene or even Buna S might be suitable for these purposes, and some development work already has been done with these materials.

Another group of products are those that can be classified as containers—fuel cells for aircraft are the most important. The coated fabrics industry has played a very important part in the pioneer work on these fuel cells. Although fabrics are not used so much at present, the sheet materials being fabricated for their construction still are being made in some volume by the people who have coated fabrics in the past for that purpose. For this use, Neoprene and more recently Hycar have been the preferred materials. Other containers which come under this general classification are food bags and water bags. In the past both of these have been made of rubber, but polyvinyl butyral-coated fabrics do an excellent job and Buna S may find an application in this field.

The next group of products are those used by the Medical Corps. Hospital sheeting and rubber-coated fabrics were synonymous in the past. Here is another case where it is not a matter of life saving. It is a matter of protection of hospital equipment—mattresses, etc.—and vinyl chloride copolymers, polyvinyl butyral and synthetic rubbers do a satisfactory job. This has also been true with regard to hot water bags, ice bags and some of the other medical supplies.

There is a miscellaneous group of coated fabrics used for such items as photo tents and flexible tubing for carrying air in ventilating gun turrets on ships. In the beginning they were all made of rubber. Then they were made with Neoprene and now we find that the synthetic resin coatings will do an excellent job, even better than rubber. Coated fabrics are needed for diaphragms and gaskets in aircraft carburetors, gaskets in sealing metal tanks and other miscellaneous devices that are used in a mechanical way. For these applications Neoprene and other synthetic rubbers have been found the most suitable. Probably these items cannot be made of anything else because of the special characteristics that must be built into them. The resins do not seem to have the resiliency required.

Conclusion

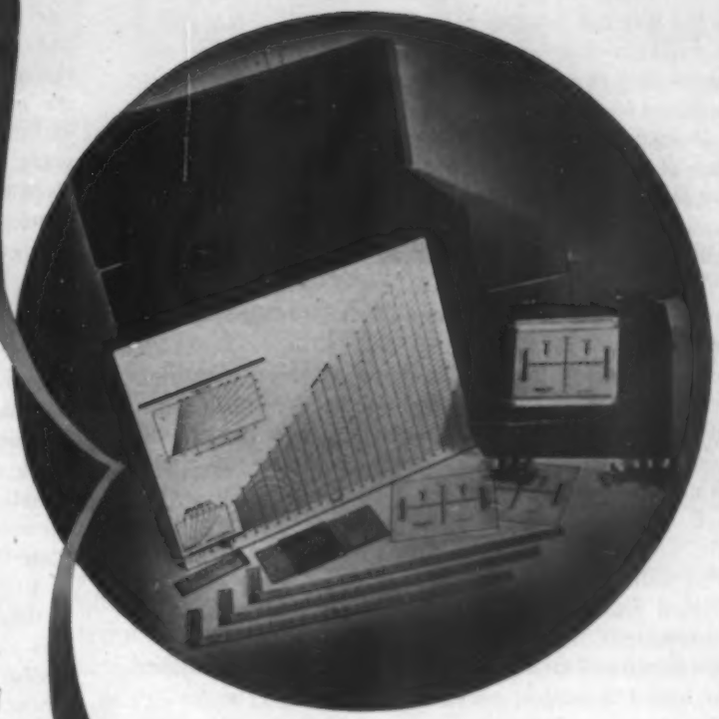
Imitation leathers used for upholstery purposes on airplane seats, tank seats and crash pads, office furniture, furniture on board battleships, etc., have previously been made of rubber-coated fabrics to a very large degree. Cellulose nitrate-coated fabrics also have been used in these applications. However, it has been found that Neoprene, Perbunan or vinyl chloride copolymers offer advantages over rubber or cellulose nitrate coatings in that the materials can be made longer wearing and can be made fireproof more readily. This article gives a brief high-spot picture of what the rubber-coated fabrics industry has done in adapting these new materials and despite the rubber shortage in keeping up the supply of coated fabrics required by the Armed Forces.

DIRECT HIT

This Assessing Device is used for testing the accuracy of torpedoes fired from airplanes. Photographically, it tells exactly where the torpedo would have hit the target, or if it would have missed and why.

This device, designed in England, has been re-engineered by Cruver to eliminate aluminum. Not only was this strategic metal saved, but the machine now works faster than formerly. The printed parts are more legible and last considerably longer because they are protected by lamination. Production in plastics is faster, and cost considerably lower.

This is another of Cruver's wartime engineering feats which prove our ability to handle plastics for all industries, all purposes.



Photographic device for testing accuracy of aerial torpedoing is re-engineered by Cruver for efficiency and economy.

Cruver

MANUFACTURING COMPANY

NEW YORK
2 West 46th St.
Wisconsin 7-8847

CHICAGO
2456 W. JACKSON BLVD.
Seeley 1300

WASHINGTON
Hotel Washington
Met. 5-900, Ext. 650

SPECIALISTS IN CONVERTING PLASTICS TO WAR

Injection molding of nylon

(*Continued from page 120*) the design of sprue bushings, runners, cold-slug wells and gates. Generally speaking, the sprue and runners may be smaller than for conventional plastics but must be large enough to ensure free passage of the molten material without premature setting. Cold-slug wells must be large and should be incorporated at the end of all major runners to prevent the entry of cold "fronts" of advancing material into the molded article.

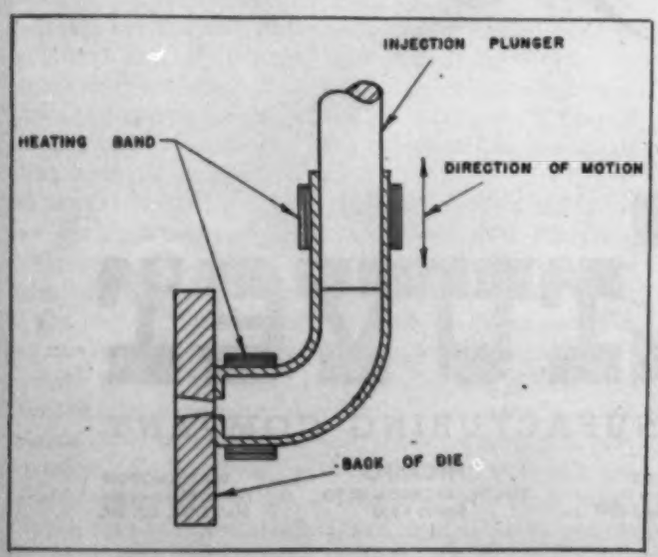
The mold shrinkage of nylon is 0.012 in. per in., considerably above that of conventional thermoplastics. Accordingly, dies designed for the latter will generally require modification for use with nylon. For the injection of nylon the temperature of the die is not nearly so important as for those thermoplastics which depend on cooling of die to make them progressively more rigid. In most cases the die may be allowed to build up an equilibrium temperature from the heat of the injected material. If too rapid setting prevents perfect filling of the die, hot water or steam is used to raise its temperature.

The same fluidity which is troublesome through causing flashing from imperfectly matched dies is advantageous in that it permits the pressure of the plunger to be transmitted hydrostatically to the material in the die cavity. For this reason no benefit to the quality of the molded piece is gained through using pressures above that required to ensure filling the die. Pressures as low as 4500 p.s.i. have given satisfactory results. How much less is practicable has not been determined since no machine has been available to provide lower pressures.

If the construction or condition of the die permits flashing at the lowest available pressure, recourse may be had to lowering its temperature somewhat or to altering the cycle. The length of the cycle, which must depend in part upon the weight of the article to be molded, should be restricted as far as possible in order to minimize the time between the actual melting and the resolidification of the nylon. The length of dwell has been found to influence the physical properties of the molded article. For test specimens, an optimum cycle of 30 sec. has been established with a dwell of 15 seconds. The time of dwell required will depend on the size and shape of the piece, the need for toughness and the necessity of ensuring complete filling of the die. In most cases where the cycle is less than 45 sec., the dwell should be approximately half the length of the cycle. Longer cycles require longer dwell periods which must be determined by the molder.

The difficulties in injection-molding of nylon increase with the thickness of the piece, particularly above 0.125 inch. In passing from a molten state to a solid, there is a contraction in volume of 16 percent. If the injection pressure and cycle are not adjusted to keep the material under pressure throughout the dwell period, the molded piece will not fill the mold. At the present time because of stresses set up within the pieces and contractions which produce surface voids, it is not recommended to use this material in articles of cross-sections greater than $^3/_8$ inch. Obviously, as modifications in material and in processing technique are developed, thicker wall sections will be feasible.

19—This standard sliding head on the vertical cylinder of an injection machine serves as an effective shutoff



19

Industrial applications

(*Continued from page 88*) pany technicians to improve their acid resisting qualities, again the close cooperation of the supplier was an important factor in the ultimate success of the shields.

Indicative of the scope of applications considered for thermosetting resins, the mammoth experimental trunnion plate (Fig. 14) is the largest structural thermosetting plastic casting yet produced. An important part in the production of the center panel sections of the Commando, the casting of this plate was undertaken with the expectation that, if successful, it would provide the answer to problems encountered when using trunnion plates made of steel. The optimum trunnion plate for this specific application should meet the following requirements:

1. Surface: flat, within .002 in.
2. Deflection: not more than .006 in.
3. Load: vertical load of 5000 lb. applied at extreme ends of plate.
4. Stability: sudden temperature changes and aging to have minimum effect on items 1 and 2.
5. Weight: minimum, while incorporating above items.

There were added considerations pertaining to the casting of the plastic trunnion. The mold was to be used for right and left applications, and no pattern was to be used. In the face of admittedly adverse casting and curing conditions, even the most optimistic of those making the test were reluctant to believe it could be achieved. With a complete understanding of these conditions but possessing some of the spirit found in every pioneer, engineers made the cast without benefit of proper equipment or an oven large enough to accommodate the entire cast during the curing process.

Measuring 13 ft. long, 3 ft. 4 in. high and 10 in. thick, this massive plastic casting weighs slightly under 1000 pounds. Although the massive phenolic casting did not conform to the requirements of the optimum trunnion plate, the results obtained under the adverse production conditions were gratifying and have assured further studies along these lines. The ability to make this huge cast of thermosetting resin is an indication of the advanced state of the airplane company's plastic program and demonstrates that thermosetting plastics may be handled in bulk where proper facilities and technique are equal to the resins involved.

In the baking of a cake identical recipes, materials and equipment are no guarantee that identical results will be

You save time and money over and over...with this Delta Cut-Off Machine

...Cuts with *polished smoothness* — eliminating expensive finishing operations

There's no end to the applications of this versatile Delta machine — wherever material must be cut to exact length on a production basis. It cuts plastics such as Bakelite and Celeron — similar rod and tube stock made of fabric or paper composition — non-ferrous metals including thin-walled brass or copper tubing — and is readily convertible to abrasive cutting of steel. Choice of 5 specially developed high-speed blades — automatically lubricated to produce an accurate, polished cut *at any angle;* expensive polishing and burring unnecessary. Soundly designed and substantially built for accuracy through a long, troublefree life... Install this fast, modern machine, and enjoy plenty of compliments on its performance. Consult your Delta industrial distributor (Delta sells only through distributors).

Mail coupon for latest Delta catalog. P-5

All these advantages — and they cost so little!

Saw arbor pivots; fence and outer table are rigid — assuring accuracy of feed at any angle.

Universal clamp holds all shapes and sizes securely.

Arbor bearings; lubricated-for-life ball bearings, Sealed into replacable diamond-bored cartridge.

Texrope drive — powerful, efficient — running on fully machined, dynamically balanced solid steel pulleys, free from vibration.

Safety guards — heavy blade guard, belt guard, chip guard.

Many other features — see catalog.

Price f.o.b. Milwaukee, without saw blade, motor, or switch $167.65

A-1-A Priority required.

DELTA
MILWAUKEE
Machine Tools

Tear out and mail today

THE DELTA MANUFACTURING CO.
624M E. Vienna Ave., Milwaukee 1, Wis.

Please send me your new catalog giving full details on the Delta Cut-Off Machine and your full line of low-cost machine tools.

Name..... Position.....

Company.....

Address.....

City..... (.....) State.....

produced by two cooks. The "know how" factor is important. And it is the same with thermosetting plastics. All the experiments which have led to the successful operation of the many industrial applications of these plastics within this airplane company have emphasized this fact. Through its testing and research the company in cooperation with resin suppliers is endeavoring to develop this knowledge to the highest possible degree.

The industrial applications are broad, the field is fertile and the shortage of otherwise common materials has spurred the investigation and applications of phenolic resins to new heights. This progress report has been presented in the hope that new interest may be created which will result in more rapid progress within this field. The present battle of production has been greatly benefited. With accelerated interest the postwar plans of industry will profit from the latent and potential applications in this vast unopened storehouse—a storehouse to which only now are we beginning to fit the master key.

Credits—Materials: Catalin and Durez. Cast by Curtiss-Wright Corp.

Resin impregnation of wood

(*Continued from page 126*) stresses of fastenings at the root of wing parts. Ski and sled runners faced with compreg are faster and wear better than the plain wood. A small but interesting use for compreg is for parallel rulers where hardness and freedom from warping are required. Development of decking of impregnated and partially compressed plywood has long been under way. The stabilizing, waterproofing and hardening effect of the treatment may render it worth while for certain types of boats.

Probably one of the most promising of the many suggested applications for impreg is as the face ply in the skins of some plywood aircraft and in the shells of boats, pontoons and other structures requiring special water resistance. These items are in production and current use. We see no justification for considering dense compreg in aircraft skins or in any such structure where stiffness for a given weight is important.

Earlier we had envisioned numerous peacetime applications as in furniture, paneling, housing and luggage, but these naturally do not now receive attention. Compreg and impreg have definite purposes to fulfill as engineering materials and we are continuing our work to develop them properly for those purposes.

Supplement to surgery

(*Continued from page 94*) and perhaps a little rouge and eye shadow applied along the line where the artificial member joins the skin and replaced from time to time as they wear off, conceals any artificial appearance. The plastic replacement is very thin at the joining line which permits natural skin tones to show through.

The plastics preparation is non-toxic and the artificial member may be worn several days without removal. Eventually, however, it changes color and must be renewed. Being soft, the vinyl material sometimes becomes damaged and must be replaced. Once a plaster mold has been made, this replacement is a simple matter and requires but a few minutes to accomplish. Neither the method nor the material is considered perfect. Chemists are at work on a sponge core to be built into solid members such as noses and ears to make them lighter in weight. But it remains essential that the material be moldable in a simple plaster mold, that it be flexible and skin-like in appearance, and that it be capable of taking pigments without changing their colors over a reasonable period of time. Only in this way can self-restoration be achieved.

Each plaster mold is as distinctly individual as a set of artificial teeth. With the mold in his possession, the patient becomes self-reliant and can maintain his normal appearance between operations. After the first stage of self-consciousness passes, he will think no more about the transfiguration than he would about wearing dentures after his teeth have been pulled. He will be able to return to his home and circulate among friends without embarrassment instead of remaining in seclusion with the horrible thought that he may be disfigured for life.

Future plans

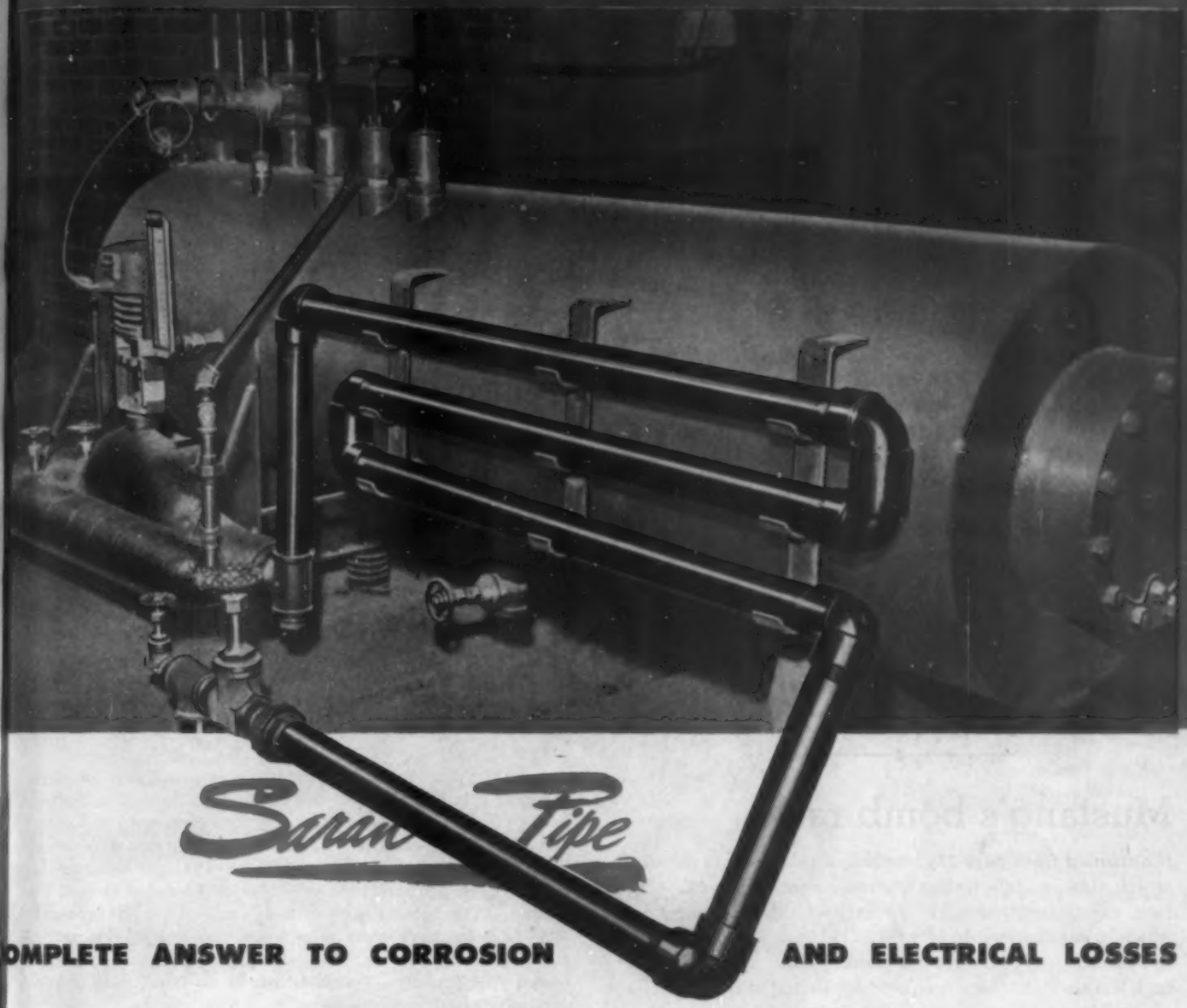
There is a plan under consideration embracing a school in which commissioned officers will study Dawn's methods and teach them to other officers and injured individuals, especially those who have had some training or experience in sculpture or art. In turn, these students will become instructors in other schools or laboratories in medical centers throughout the country where treatment will be available. Individual molds will be made for patients in each area, and they will be shown how to use them. Supplies of plastics materials will be made available at these centers, and patients will be coached in the intricate method of pigmentation as it applies to each individual case. This method of restoration goes much further than replacing superficial members of the human face. Hands with one remaining finger or thumb have been so carefully reconstructed it would be difficult for anyone to realize restoration had taken place. Muscles, veins, wrinkles, nails, even hair growing on the back of the hand, have been faithfully reproduced. If one digit remains it is often possible after a little practise for it to function quite naturally in conjunction with replaced members so that normal use is partially restored. Such plastic replacements are accomplished by the same method of molding in a plaster mold after a clay model has been made. It attaches to the arm with a glove-like sleeve entirely concealed by the plastic material.

In extreme instances of facial disfiguration a complete mask can be made in which eyebrows and lids are modeled to conceal deep burns. Such cases are rare but when they occur, nothing so brightens the patient as the thought that he will soon be able to meet friends again without embarrassment. Frequently it accelerates his wish to get well. And whether in war or peace the will to get well is essential to the speedy recovery of any hospitalized patient.

Redesigned dental surveyor

(*Continued from page 94*) of the double cross arm which swings around the center column to permit contact of the carbon rod with a dental plate mounted on the table. An adjusting screw mechanism inserted in the lower half of this arm provides smooth yet rigid control of the vertical spindle. There is a simple screw-chuck device on the bottom of this spindle, similar to the type used on many mechanical pencils, which holds the marking lead or steel analyzing rod used in the operation of the instrument. (*Please turn to next page*)

PLASTIC PIPE INCREASES EFFICIENCY OF RECTIFIER UNITS



OMPLETE ANSWER TO CORROSION AND ELECTRICAL LOSSES

Piping cooling water for rectifier units has always raised a tough problem. Corrosion and electrical losses are two of the principal difficulties encountered. Saran pipe now comes up with the right answer.

Here is a strategic material of long life whose surpassing corrosion resistance and insulation value, as well as its surprising ease of installation, precisely fulfill the severe requirements of equipment of this character.

As the water flows from the rectifier jackets to heat exchangers through Saran pipe, the exceptional insulating properties of this plastic material prevent the electrical potential from being grounded through the heat exchangers. Thus, electrical losses are reduced. Furthermore, Saran is a material that does not corrode. It has a far higher degree of corrosion resistance than any of the common metals used for equipment of this kind.

Close-up of Saran pipe and fittings showing connections to the rectifier.

Installing Saran pipe requires no special tools and presents no problem. All in all Saran pipe provides a complete answer and is receiving a warm welcome from engineers who have the responsibility of designing these units.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN
New York • Cleveland • Chicago • St. Louis • Houston
San Francisco • Los Angeles • Seattle

SARAN

RAW MATERIALS

STYRON • ETHOCEL

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

Another feature of the surveyor is the "hemisphere and saucer" design of the tilt-top table. This unit consists of a saucer which holds a semi-spherical tilt top. A sheet of 30-gage soft sheet wax, employed in the saucer as a grip for the table, permits infinite adjustment of the top to required angles—the friction of the wax effectively holding the semi-spherical top in position against the comparatively slight pressures exerted upon it. If this wax liner becomes worn or damaged it can be replaced very easily. As can be seen in Fig. 2 the tilt-top table has a serrated surface which receives soft wax for mounting the model. The polished black glass base, 8-in. in diameter, serves as a baseboard for the other parts of the plastic surveyor.

While this dental surveyor is not directly comparable with the old instrument since it cannot be used for attachment work or milling and drilling due to its lesser strength and rigidity, it appears to be slightly easier to operate and does excellent work. In addition, the cost of the plastic instrument is less than that of the old metal unit. This instrument is a striking example of the results that can be obtained by the pooling of talent. It indicates the actual improvements which can be made in parts and instruments through the proper use of plastics materials.

Credits—Surveyor body fabricated of Lucite and Plexiglas by Plax Corp. Tilt-top table molded of Plaskon by Colts' Patent Fire Arms Mfg. Co. Base plate made of Carrara plate glass by Pittsburgh Plate Glass Co. Surveyor unit assembled and distributed by J. M. Ney Co.

Mustang's bomb rack

(*Continued from page 77*) insufficient plastics data at hand at the time, metals testing methods were employed. The rack was tested thoroughly for each of the 3 purposes for which it was destined to be used: (1) bomb loads; (2) ferry tank loads; and (3) combat tank loads. In conducting each test the bomb rack specimen was bolted to the back of a channel iron which was attached to 2 large "A" frames supported on the abutment. The method of loading it for each purpose, was different:

(1) *Bomb loads*—the load was applied by fixing a 500-lb. bomb casing in the rack and applying the vertical, side and drag loads to this casing with screw jacks and hydraulic pressure (Fig. 3).

(2) *Ferry tank loads*—the load was applied by attaching a vertical hydraulic strut to the forward hook and another to the aft hook. No side or drag shear loads were applied since these loads are not carried by the housing in the ferry tank installation (Fig. 4).

(3) *Combat tank loads*—the load was applied by means of a special jig which was attached to the forward and aft hooks. The vertical, side and drag loads were applied to the rack by means of this jig and separately arranged hydraulic struts (Figs. 5 and 6).

The development and perfection of the plastic bomb rack attests in no uncertain way to the high engineering standards employed by aircraft manufacturers in the United States and indicates one of the reasons why our fighting ships of the air have rendered such brilliant performance in foreign combat service.

Credits—Bomb rack engineering design by North American Aviation, Inc. Mold design and molding by Westinghouse Electric & Manufacturing Co.

Washington round-up

(*Continued from page 150*) Biggest single use of phenol—about 50 percent of the entire output—is for plastics. Most of the balance is exported or used for explosives, oil additives, disinfectants, fungicides, medicinals, etc. It is anticipated that the Armed Forces will ask for and expect increased production of phenol for phenolic resins in 1944. Facilities are available for a stepped-up program of considerable quantity, but it should be pointed out again that in addition to its importance in the manufacture of aviation gasoline, benzol is also necessary for styrene and the latter is needed for synthetic rubber. Therefore, benzol needed for phenolics must compete with benzol needed for aviation gasoline and rubber tires. No one can tell exactly what will happen to the phenol program under these circumstances, but there will probably be sufficient for important uses.

Cresol.—Cresol is another tar acid derivative similar in some respects to phenol. The resins made from it are classified generally as "phenolic." It is used particularly in laminating resins. Shipments from abroad have opened up, and consequently more is coming in although the price is higher than domestic cresol. In England, cresol is relatively more abundant due to different manufacturing processes. In the early part of the war the cresol situation was quite serious, especially among laminators, and several substitutes were devised. Today, however, cresol is available in needed quantities for essential goods and should remain so unless shipping is again interfered with in a more serious way. Much of the exported phenol mentioned above is virtually traded for cresol so that both the United States and England can derive the greatest benefit from divided use.

Formaldehyde.—Formaldehyde is an essential part of most phenolics. It is made from methanol which in turn is derived from carbon monoxide and hydrogen. A new process now going into large-scale production captures refinery gases and converts them into methanol. More will be heard of this process after the war. A high percent of all formaldehyde produced is used for plastics. The balance goes into a wide variety of products. New facilities have come into production during the past 6 months. From now on, there should be enough to meet essential requirements. Formaldehyde is no bottleneck in production of plastic formulations.

Urea.—The urea situation is good. New production capacity has recently been added which assures sufficient quantity for all military and important civilian uses such as fertilizer. While more than half goes to plastics at present a small portion now is going into cattle feed. If the fertilizer or explosive situation suddenly should require rapid expansion, urea molding powder would be hard hit because all these products use the same raw materials. While no one anticipates that eventuality, it remains one of the imponderables which face WPB officials.

Incidentally, WPB's handling of the urea and phenolic allocation orders are good examples of the allocation system working at its best. Before they went into effect, there is no telling how much of these vital war materials went into unessential items such as brush backs. The administrators soon learned that inventory and scrap control was the key to the situation. When the orders first were initiated some users asked for great quantities to be used for non-essential and border-line cases. The non-essential items were ruthlessly denied. Today, many of the border-line cases are allowed almost in full because molders and fabricators have learned that they can't get a pound for non-essential purposes and consequently don't apply.

Vulcanized fibre.—This handy material made from paper treated with zinc chloride and equally useful for faucet washers, railroad signal installations, fuses, tubing and hundreds of intricate items for military use, now is slightly more free than it has been at any time during the war. But officials have their fingers crossed. So many uses can be found that no one knows when the Armed Forces may turn up with an order that will

precision production of instruments, dial faces, name plates, etc., calls for a tough thermoplastic terial that will neither shrink nor warp in service. Printing, too, must be accurate, clean-cut, manently legible.

lite sheet materials guarantee dimensional stability and toughness, while our exclusively eloped mechanical plate making method imparts sharply defined, accurate impressions. To this, addition of a protective lamination assures legibility and permanence, regardless of the abrasive on and friction of normal wear.

use of our experience in the manufacture of a great variety of laminated products for essential ustries and various branches of the Army and Navy, we now welcome the opportunity of sup- g your laminated thermoplastic requirements. Send prints for prompt estimate.

IRGINIA PLAK CO. 270 MADISON AVE., NEW YORK 16

Laminated Sheet Plastics are now extensively used for:

DIAL FACES
NAME PLATES
SCALE PLATES
PROTRACTORS
PLOTTING BOARDS
RULES
CLOCK FACES
TRANSPARENCIES
MARKERS
CHARTS

Paper Maps, Charts, etc., can be permanently protected by laminating between thermoplastic sheets.

SPECIFICATIONS GUIDE

CONSTRUCTION:

Printing is done on transparent, translucent or opaque thermoplastic sheets. A transparent sheet is then laminated over the printed surface . . . thus rendering the product impervious to friction, moisture, oil and acids.

FINISH:

Laminated surfaces are available in either glossy or matte (non-glare) finishes. Matte is desirable when notations must be made and erased.

PLATE MAKING:

Our exclusive mechanical plate-making development assures precision.

SIZES AND THICKNESSES:

Our facilities enable us to laminate sheet sizes up to 35½"x38", in thickness from .010" to .250".

COLORS:

Any color or combination of colors can be printed.

SERIAL NUMBERS, etc.:

Numerals may be incorporated during the printing process or stamped later with metal punches.

IS YOUR DESIGN PROBLEM IN WAR-TIME OR PEACE-TIME PLASTICS APPROACHED BY ANY OF THESE PRODUCTS?

Since the beginning of plastics in this country, we have produced hundreds of mechanical and ornamental products — from simple balls, caps, handles, etc., up to highly intricate metal-and-plastic combinations. If we do not have examples of actual products that will help you, the long experience of our engineers is at your service . . . in the improvement of present products, in the development of new ones. Deliveries take time. Please contact us early.

Waterbury Plastics
THE WATERBURY BUTTON CO.
WATERBURY, CONN., U. S. A.
WBC
EST. 1812

make vulcanized fibre tight. First public indication that vulcanized fibre was loosening up was award of the ration token job. A few months ago, it would have been impossible to provide enough vulcanized fibre for this job.

Due in part to a lack of suitable man-power, the supply of vulcanized fibre in tubing form is not currently adequate for demands placed for such uses as electrical fuses and other insulating members. This situation is being followed closely with a view toward seeing that all important uses are covered at a rate consistent with immediate requirements.

Cellulose acetate and cellulose acetate butyrate.—Rods, tubes, sheets and molding powder are the end products of cotton linters, acetic acid, butyric acid and their anhydrides. None of these items are particularly tight, but they all are on allocation and valuable in the manufacture of many other critical materials. It is believed that the recent allocation order on acetic acid and anhydride will assure a more certain flow of these chemicals into the plastics field. The great trouble with acetate esters has been that processors were asking for more material than they needed to fill their orders. Just as soon as processors learn that they cannot beat the game by trying all sorts of schemes to get more acetate for unessential items, the acetate situation will clear up. It may take an amendment to the order in the form of a more strict reporting method, but sooner or later WPB officials will certainly find a way to eliminate inflated orders and excess inventories.

There is some complaint about lipsticks and other items which occasionally get on the allowed list and remarks about their comparative essentiality with such things as lunch boxes. However when the figures are examined, it generally is found that the allocation to lipsticks or kindred items is exceedingly small and permitted only because of unusual circumstances.

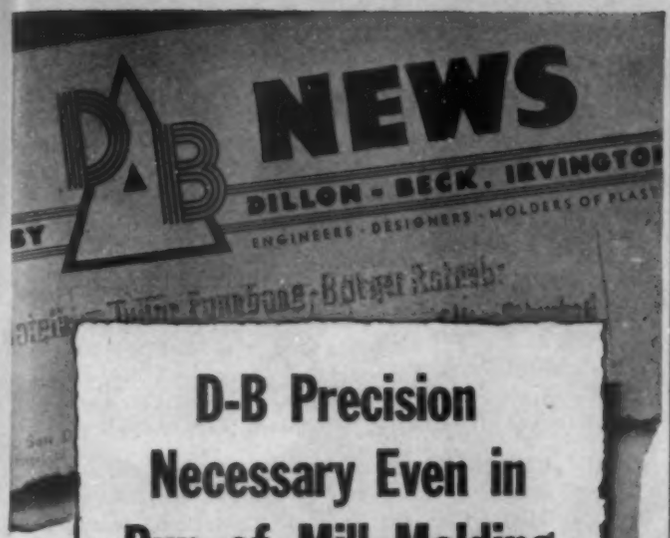
Plasticizers.—Plasticizers are most important in the amount of cellulose esters that can be made available since acetate formulations take from 30 to 50 percent plasticizer. Many of the most important plasticizers come from coal tar but in even more infinitesimal parts than benzol or cresol. They are used for many kinds of chemical products. While the situation is improving—considerably in the last 2 months—their future availability is more difficult to predict than almost any other chemical needed in plastic production.

Polystyrene.—Everybody knows that the new styrene plants, built largely as an adjunct to the synthetic rubber program, are or soon will be in full production. A comparatively small amount would be needed to make all the polystyrene that can be used by present facilities. It now is in good supply and should continue so unless benzol, used in styrene production, should become a bottleneck.

Methylmethacrylate and ethyl cellulose.—Scarcely any use talking about these in so far as ordinary civilian uses are concerned. The first used as glazing and the second for many military purposes (prominently as tubing) probably will be unavailable for any sizable civilian use during the war. The acrylics have been in fairly good supply for the last couple of months, but raw material difficulties are beginning to cause a general tightening of the end use pattern.

Speeches of the month

(*Continued from page 156*) discussed the sources of rubber and compared various characteristics of the synthetic and natural product. He said that one of the difficulties in the present synthetic tire program is in the development of a means of impregnating the fabric in the tire, and expressed the opinion that before the end of the war synthetic tires will be produced to last for the life of an automobile. Following Dr. Turner's talk a motion picture entitled "Rubber Goes Synthetic" was shown. The next meeting of the Association will be held Nov. 15 at 8:15 p.m. at the Engineering Building with Earl Simonds speaking on "Post-war Potentialities of Plastics." (*Please turn to next page*)



D-B Precision Necessary Even in Run-of-Mill Molding

IRVINGTON, N. J.—Today, in production's war against time, even commonplace molding applications have to reach a new high in precision. This fact was stressed by an officer of the Dillon-Beck Mfg. Co. in reporting on the shipping plugs and thread protectors they are producing in large quantities for the Curtiss-Wright Propeller Division.

"This customer's precision requirements," he stated, "are, of necessity, very exacting and even the simplest applications must meet that standard.

"We consider these plugs and protectors a run-of-the-mill molding job. Despite this, they still presented their own particular problems because most of them call for thread dimensions that are not standard, yet which have to be extremely accurate. In addition, the larger items involved questions of shrinkage and dimensional stability which had to be carefully worked out so that the thread would remain serviceable."

These applications are performing an important war task in guarding closely machined threads from possible damage during inter-plant and overseas shipments of spare parts. A recent study made by Curtiss-Wright showed that use of the protectors had largely eliminated rejections due to dented threads.

DILLON-BECK MANUFACTURING COMPANY
IRVINGTON, N. J.
ENGINEERS · DESIGNERS · MOLDERS

WOMEN WORKERS
and all GREEN HANDS *can drive*

HOLTITE-Phillips SCREWS & BOLTS
with Speed, Safety and Efficiency

Because these modern fastenings for plastics can be safely and efficiently hand or power driven by inexperienced workers, basic training time is drastically shortened, and production quickly increased. Especially proficient with power drivers, women have replaced men in many plant departments throughout the country. Experienced workers can cut fastening time up to 50% and more with a comparable saving in cost.

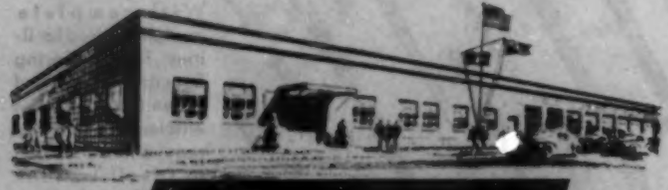
Further time-saving is effected when HOLTITE "Thread-Forming" screws are used to fasten plastic parts. By cutting their own perfect mating threads in the material, tapping operations are eliminated to save an extra operation.

Profit by these efficient savings in your assembly line NOW.

With complete equipment and facilities for producing Special parts and fastenings, we can efficiently meet any requirement, exact to specifications. Send blueprint, specifications or sample.

CONTINENTAL SCREW CO.
New Bedford, Mass. U.S.A.
BUY MORE BONDS

PLANNING for Peace while war prevails is a job which confronts all industry. The best argument for this is: if we had planned for war while peace prevailed—how different this war would have been! While we are busy, at present, with war time jobs, we are also ready to discuss with manufacturers plans for the post-war period. Let us not leave the future to chance, but rather plan for it now so that it may be different than the "last time".



Franklin

FRANKLIN PLASTICS DIVISION
Robinson Industries Inc., -- FRANKLIN, PA.

★ NEW YORK INSTITUTE OF FINANCE IS PRESENTing a series of authoritative and instructive lectures on the major types of commercial plastics. Future meetings which will be held in the Governing Room, New York Stock Exchange, New York City, from 3:30 to 5 p.m. are as follows: Nov. 1, "Bakelite and Vinylite" speaker to be announced; Nov. 8, "Plastic Plywood" by L. Ottinger, president, U. S. Plywood Corp.; Nov. 15, "Nylon" by Theodore G. Joslin, E. I. du Pont de Nemours & Co., Inc.

★ THE BOSTON CONFERENCE ON DISTRIBUTION which was held on Oct. 18 and 19 in Boston, Mass., was addressed by Charles A. Breskin, managing director of MODERN PLASTICS, on the subject of "This Plastics Age." Following a brief description of the nature and form of plastics, Mr. Breskin outlined present uses of the materials and anticipated postwar applications.

★ THE RUBBER AND PLASTIC DIV., SOCIETY OF Chemical Industry, Canada, held its first meeting of the year on Oct. 1 at McGill University. Dr. I. R. McHaffie, manager of Research and Development, Canadian Industries Ltd., spoke on "The Manufacture of Plastics Materials." His talk covered the chemistry involved in the manufacture of thermoplastic resins with some discussion of the thermosetting resins. At the close of the meeting the MODERN PLASTICS color and sound film, "This Plastic Age," was shown.

★ THE KNOXVILLE SECTION OF AMERICAN CHEMical Society at a meeting on Oct. 21 was told by Dr. D. S. Frederick of Rohm & Haas Co., that acrylic acid today is the basis of the transparent acrylate family from which noses, turrets and other transparent gun posts in U. S. bombers are formed. Dr. Frederick also reported that recently-perfected acrylic compounds were used in making synthetic rubber, adhesives, vehicles for luminous paints, vitamin bases, and for making oils free-flowing in sub-zero and stratosphere temperatures.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933, OF MODERN PLASTICS, published monthly at Easton, Pennsylvania, for November 1, 1943.

State of New York } ss.
County of Kings }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Chas. A. Breskin, who, having been duly sworn according to law, deposes and says that he is the Publisher of the MODERN PLASTICS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, Chas. A. Breskin, 122 E. 42nd St., New York City.
Editor, Chas. A. Breskin, 122 E. 42nd St., New York City.
Managing Editor, Harriet B. Josephs, 122 E. 42nd St., New York City.
Business Manager, A. S. Cole, 122 E. 42nd St., New York City.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)
Breskin Publishing Corp., 122 E. 42nd St., New York City.
Chas. A. Breskin, 122 E. 42nd St., New York City.
Mrs. C. A. Breskin, 55 Park Road, Scarsdale, N. Y.
Linda S. Breskin, 55 Park Road, Scarsdale, N. Y.
Theodore B. Breskin, 55 Park Road, Scarsdale, N. Y.
Mrs. Helen K. Cole, 246 Coligni Ave., New Rochelle, N. Y.
S. Moisseiff, 99 Wall St., New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:
None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

CHARLES A. BRESKIN, Publisher

Sworn to and subscribed before me this 13th day of October, 1943.

[SEAL] HERMAN L. ISLER
Notary Public, Kings County

Kings County Clerk's No. 11, Register's No. 4000
New York County Clerk's No. 36, Register's No. 4-4-14.
(My commission expires March 30, 1944.)

Precision Scales for Plastics Molding Operations . . .

EXACT WEIGHT Scale in a plastics molding operation on the west coast, in the plant of McDonald Manufacturing Co. Los Angeles, Calif.

do it the Exact Weight Way . . .

Plastics molding is an exacting operation. Skill of course is important but much of this skill is a careful weighing operation of the ingredients involved. EXACT WEIGHT Scales have been in the plastic industry from the first, even from the research laboratory days. Today this equipment can be found throughout the whole rapidly growing industry from coast to coast. Many different models are available for various operations such as ingredient compounding, color blending and check-weighing. Write for details for your plant today.

THE EXACT WEIGHT SCALE COMPANY

650 W. Fifth Ave., Columbus 8, Ohio

Dept. As. Toronto, Canada

Exact Weight Scales

PHENOPREG

BONDING and SURFACING *Materials* for VENEERS and PLYWOODS

We are producing the following grades of PHENOPREG (phenolic impregnated) materials for bonding and surfacing applications:

Phenopreg No. 70-B—7 mil base sheet treated to a high resin content with a special resin formulation. Employed in bonding phenolic laminates, either sheet or curved sections, thereby eliminating the use of liquid glues or the use of metal rivets or bolts. Will produce a satisfactory bond under heat and contact pressure. Can be supplied in sheet, roll or tape form. The high resin content of this grade makes it satisfactory for use as a surfacing or face sheet on plywood when high finish is required.

Phenopreg No. 114—7 mil high tensile paper satisfactory for bonding veneers or facing plywood. Can be used as a laminate where high tensile strength is required.

Phenopreg No. 49—Light weight cotton sheeting for plywood surface sheet where high abrasion resistance is required on surface of finished plywood. Increases impact value.

Bulletins on request.

D.W.P.C.

DETROIT WAX PAPER CO.

PLASTICS DIVISION

1721 Pleasant Avenue, River Rouge, 18, Michigan

Vinewood 1-8200

THERMOPLASTIC MATERIALS

PLASTIC MATERIALS

LEADING THE FIELD FOR MORE THAN 20 YEARS

HEADQUARTERS for Scrap thermoplastics: Acetate, Butyrate, Styrene, Celluloid. Acrylic and Vinyl Resins.

WE RE-PROCESS *for* **YOU—OR BUY** *from* **YOU:** We reclaim thermoplastics that are off-size or off-standard, including factory residues or scrap.

TURNING WASTE INTO USABLE MATERIAL: We are a source of supply for manufacturers who need clean and graded re-processed plastics. These are suitable for many applications where VIRGIN materials are not essential or CANNOT BE OBTAINED!

Write for details—

GERING PRODUCTS, INC.

NORTH SEVENTH ST. & MONROE AVE., KENILWORTH, NEW JERSEY

622 Monroe St. - - - - - Chicago 6, Illinois

MACK MOLDING *EXTRUSIONS*

...for present and future needs!

The basic and inherent advantages of MACK MOLDING extruded shapes are equalled only by their wide latitude in application. Beauty of finish, durability, resistance to wear, moisture, heat, fumes and acids, can all be attained by the proper selection of body.

Mack Molding engineers will gladly collaborate in the solution of extruded plastics problems, whether for present essential industrial needs, or future plannings. Inquiries are invited. Mack Molding Company, 100 Main Street, Wayne, N. J.

Mack MOLDED EXCELLENCE

SALES OFFICES: NEW YORK CITY, CHICAGO, DETROIT, INDIANAPOLIS, BOSTON & ST. LOUIS

VICTORY WILL BE OURS

BY PULLING TOGETHER!

We are here to serve our Country, and Customers Old and New, by Providing High Quality Molded Parts.

Our trademark stands for justice, and is backed by an engineering staff of more than thirty years experience.

This background is yours for the asking. Consult us with your problems, small or large, simple or complicated.

Compression and Transfer Molding of Thermosetting Materials Is Our Specialty

PLASTIMOLD, INC.
ATTLEBORO, MASS.

NEW #1/2 MODEL *Scrap Grinder*

SAVES WEIGHT AND SPACE...

New Model ½ Ball&Jewell scrap grinder with Texrope Drive, saves one-half the weight, one-half the space and gives twice the efficiency of comparable models.

Made to serve you through the war and long into the peace with sturdy castings, 10 solid tool steel knives, outboard SKF bearings sealed against plastic dust. 3 interchangeable screens permit any granulations desired.

Send for prices, FREE catalog

BALL & JEWELL

20 Franklin Street **Brooklyn, N. Y.**

Since 1895, Manufacturers of Patent Rotary Cutters

or get in touch with nearest representative.

NEW YORK: Alsing Engineering Co., 111 Eighth Ave. DETROIT: J. C. Austerberry's Sons. CHICAGO: Neff, Kohlbusch & Bissell. NEW ENGLAND: Standard Tool Co., Leominster, Mass. ST. LOUIS: Larrimore Sales Co. LOS ANGELES & SAN FRANCISCO: Machinery Sales Co. LOS ANGELES: Moore Machinery Co LONDON, ENGLAND: Blackfriar's Engineering Co., Ltd. CANADIAN AGENT: Williams & Wilson, Ltd., Toronto & Montreal, Canada

Replace Restricted Alloy Steels with

DISSTON PLASTIRON

FOR PLASTIC MOLDS

Disston Plastiron is a non-strategic, non-restricted electric furnace steel, produced by modern tool steel practice by a world-famous toolmaker.

Disston Plastiron has a very low carbon content—is thoroughly clean and uniformly sound—produces exceptionally smooth cavities—will withstand extreme hobbing—carburizes easily—and proves an ideal material for difficult shapes.

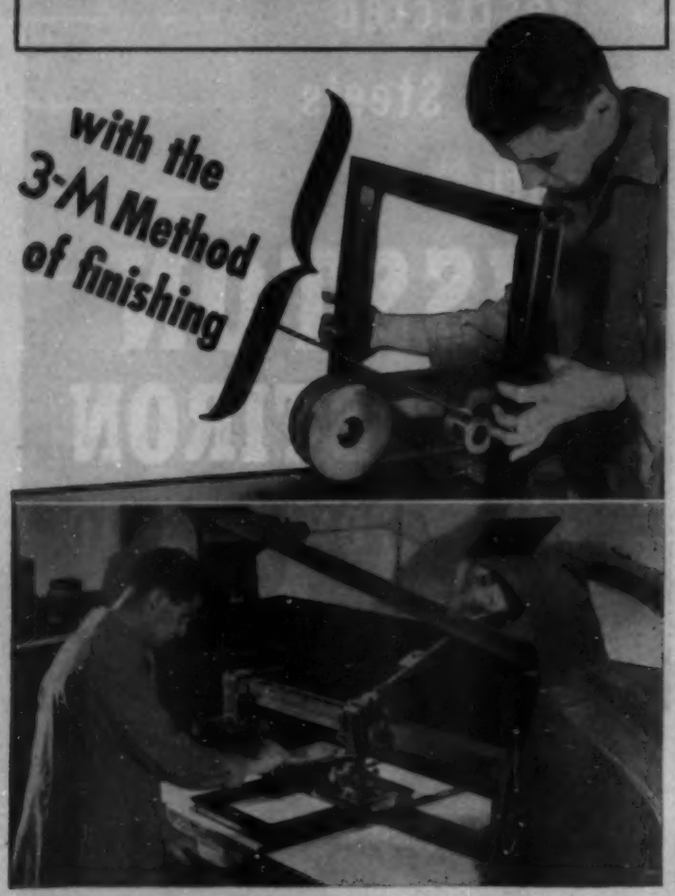
METALLURGICAL AND ENGINEERING AID from Disston specialists is available to help you use Plastiron most effectively. No obligation. Write fully to Henry Disston & Sons, Inc., 1134 Tacony, Philadelphia 35, Pa., U. S. A.

DISSTON PLASTIRON

REG. U.S. PAT. OFF.

The non-strategic steel for molds

THE TOUGHER THE JOB THE MORE TIME YOU SAVE



Putting the toughest finishing jobs on a fast production-line basis is an old story to 3-M Abrasives. Almost since the beginning of plastics, as we know them today, manufacturers have depended upon the 3-M Method of finishing to keep production high and costs low. In addition to its ability to finish surfaces of every size and shape faster and easier, the 3-M Method offers other important advantages. It makes no dust. It prevents burning and plastic flow. It eliminates loading, or clogging; the abrasive retains its fast, smooth cutting action.

A 3-M Abrasive Methods Engineer will be glad to show you how the 3-M Method saves time and money in your finishing operations. There is no obligation; just mail us the coupon below.

MINNESOTA MINING & MANUFACTURING CO.
Saint Paul 6 • *Minnesota*

Gentlemen: MPL 1143

Please have a 3-M Sales Engineer call to discuss our finishing problems:

Name.....
Department.....
Company.....
Address.....
City..... Zone... State.....

®

The first responsibility for the country's welfare rests on the individual and not on the Government.—N. Y. Sun.

RECTO
MOLDED PRODUCTS, INC.
CINCINNATI, OHIO
Melrose 6862

•

DETROIT
L. S. HOUSE
3-167 General Motors Bldg., Madison 5781

•

INJECTION AND COMPRESSION MOLDING

MERCER — ROBINSON

EQUIPMENT for the HANDLING of BULKY • CASED • HEAVY

EQUIPMENT for the PROCESSING of CHEMICAL • FOOD • PLASTIC

MATERIALS

Cranes, Elevators, Lift & Trailer Trucks, Conveyors, Live Skids, Drum Hoists, Tool Wagons, Carts, Winches

Crushers, Pulverizers, Grinders, Reducers, Cutters, Blenders, Mixers, Sifters, Attr. and Hammer Mills.

LITERATURE ON REQUEST

MERCER-ROBINSON COMPANY INC
30 CHURCH ST. • NEW YORK 7, N. Y.

PLASTICS *and* ELECTRONICS

We have been manufacturing plastic parts with special insulation qualities for more than fifty years.

With the increasing demand for plastics with high-frequency resistance, we have developed our own materials and molding techniques to meet low-loss requirements. We are producing for war many parts which meet the most rigid standards of electrical resistance.

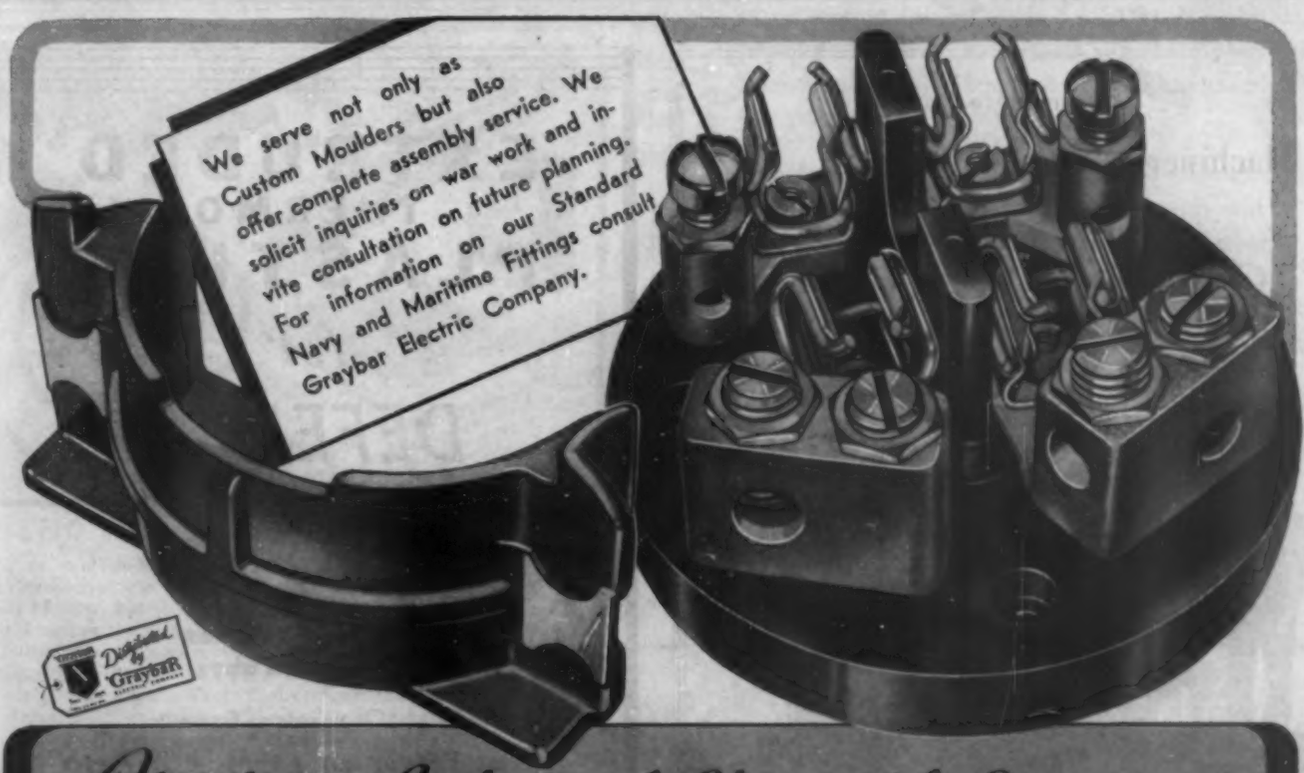
We have many stock-mold items for the electrical industry, including terminal blocks and our well-known "Safety Strain" insulators.

These items are available to war industries, and will be available to all industries after the war.

INSULATION MANUFACTURING CO.

CUSTOM MOLDERS OF PLASTICS FOR INDUSTRY

11 New York Avenue Brooklyn, N.Y.


We serve not only as
Custom Moulders but also
offer complete assembly service. We
solicit inquiries on war work and in-
vite consultation on future planning.
For information on our Standard
Navy and Maritime Fittings consult
Graybar Electric Company.
Distributed by GRAYBAR

Northern Industrial Chemical Company

7-11 ELKINS ST., SO. BOSTON 27, MASS.

35 YEARS OF PLASTIC MOLDING EXPERIENCE

MEMBER OF THE SOCIETY OF THE PLASTICS INDUSTRY

PUT YOUR *Plastics Scrap* TO WORK

Consult:

H. MUEHLSTEIN & Co. INC.

122 EAST 42nd STREET, NEW YORK, N. Y.

... 227 So. La Salle St. • AKRON: 250 Jewett St. • LOS ANGELES: 318 W. 9th St. • MEMPHIS: 46 W. Virginia Ave. • BOSTON: 31 St ...

Complete Line of

Machinery for Celluloid and Plastics Mfrs.

JOHN J. CAVAGNARO

HARRISON Engineers and Machinists ESTABLISHED 1891 NEW JERSEY

Mixers: Plain or Stainless
Preliminary or Vacuum

EXTRUDED THERMO PLASTICS *for* DEFENSE WORK

★

Shapes — Profiles
Strips — Tubes

Details, Quotations — *Promptly*

AMERICAN PLASTICS CORP.

227 West 34th St. New York City

Ameroid

Casein Plastics

A-PE-CO *is the* EASY, ACCURATE *way to make* CORRECT COPIES *for all!*

All departments have correct and complete information simultaneously when A-PE-CO photo-copies are used. This modern, mistake-proof method is expediting work and saving time and money in many industries. One or a hundred A-PE-CO photo-exact copies are made quickly, at low cost. *You* can use A-PE-CO profitably. Ask us to *show* you.

A-PE-CO "Photo Exact"

Legally-Accepted Copies of
• Letters • Documents
• Records • Blueprints
• Pictures • Drawings

A-PE-CO photo-copies direct from anything written, printed, drawn or photographed — letters, legal documents, blueprints, receipts, graphs, tracings, telegrams, shop orders — up to 18" x 22". A-PE-CO photo-copies are permanent and error proof. Thousands in use by industry, Government and engineers. Eliminate steno-copying, tracing, proofreading.

No Camera — No Film — Easy to Use

Employees learn quickly. Use A-PE-CO on any table. Low cost per copy. Lowest investment. Immediate delivery. Representatives in principal cities and Canada. Write for A-PE-CO folder.

AMERICAN PHOTOCOPY EQUIPMENT CO.
2849 N. Clark St., Dept. CP 11, Chicago 14, Ill.

Fight WITH WAR BONDS

SARAN

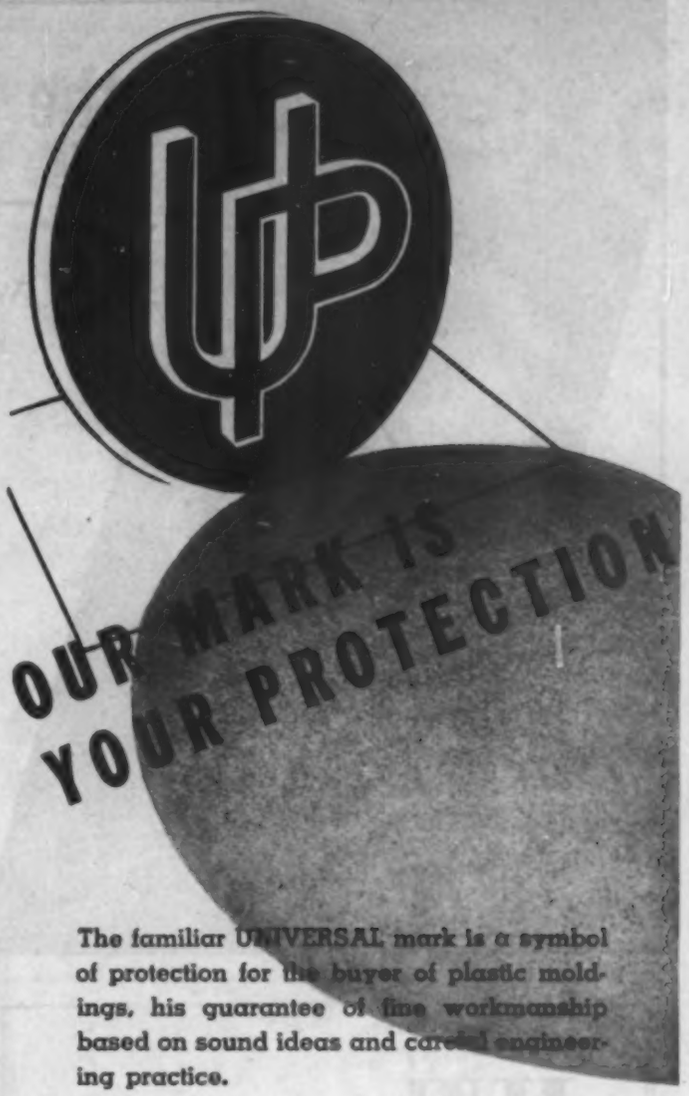
TO END ALL CORROSION PROBLEMS

Saran is a tough thermoplastic originally made to replace such strategic war materials as aluminum, stainless steel, nickel, copper, brass, tin and rubber. Now found adaptable to a wide range of uses in product designing, food processing and wherever non-corrosive materials are necessary. Its insulating qualities, flexibility and ease of handling make it extremely valuable in installations dealing with oils, gases, air, water and corrosive chemicals. It is available in tube, pipe, sheet, rod and molded fittings.

Technical Bulletin P-8 will be sent on request. Address Dept. SA

Pat. No. 2160931

HODGMAN RUBBER CO.
FRAMINGHAM, MASS.
NEW YORK . . 261 Fifth Avenue
CHICAGO . . . 412 South Wells St.
SAN FRANCISCO . . . 121 Second St.



The familiar UNIVERSAL mark is a symbol of protection for the buyer of plastic moldings, his guarantee of fine workmanship based on sound ideas and careful engineering practice.

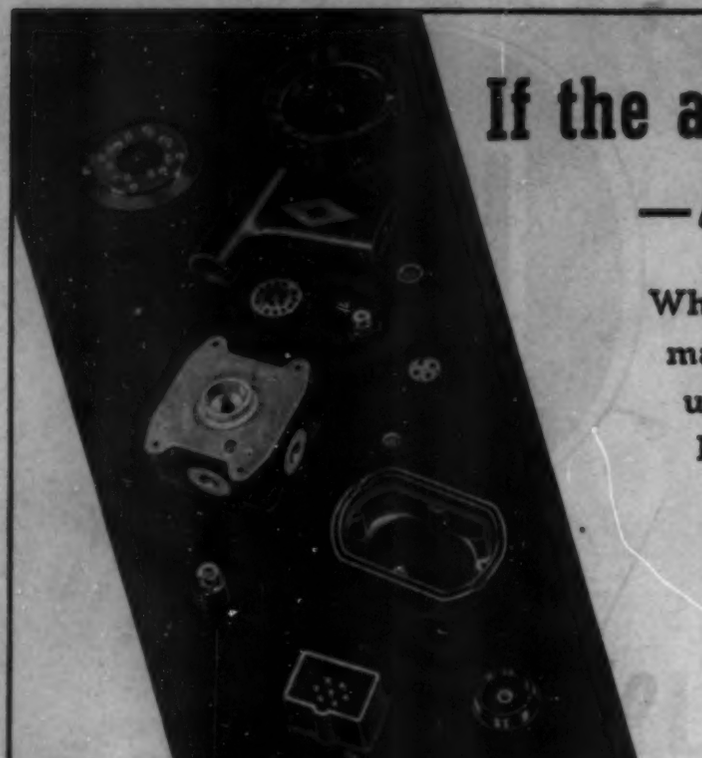
Our facilities include molding by injection and compression methods, for which our plant is ideally equipped with the latest types of molding machines and presses.

Whether you need our facilities now or merely want to discuss tomorrow's plans, please feel free to call upon the experience of our designing and production engineers. Telephone or write today.

Just now a large part of our facilities and experience is devoted to the all important job of producing moldings needed for war products and essential industrial requirements. Tomorrow these facilities will be wholly available for the production of peacetime goods.

UNIVERSAL PLASTICS CORPORATION
CUSTOM MOLDERS
New Brunswick New Jersey

NEW YORK: 12 E. 41st Street • PHILA.: Paragon Sales Co., Inc.
CHICAGO: Steel Mills Products Co. • DETROIT: June & Company



If the answer is PLASTICS
—the name is STOKES

Whatever you make, however you make it, there is some way you can use Stokes Molded Plastics or Hard Rubber to advantage. For War today and Peace tomorrow, Stokes, veteran of two long wars and fifty short years is ready as always to serve you.

JOSEPH STOKES RUBBER COMPANY

ESTABLISHED 1897

CUSTOM MOLDERS—ALL FORMS OF HARD RUBBER AND PLASTICS

TRENTON, N. J. • Canadian Plant, WELLAND, ONT.

WE build molds for all plastics

More than 20 years of successful experience as toolmaker to leading custom and proprietary molders qualify us as your mold designer and mold maker on your most exacting jobs of plastics engineering.

Fortney MOLDS FOR PLASTICS MANUFACTURING COMPANY

247 N. J. R. R. AVE. • NEWARK, N. J.

MEAD BURRING MACHINE

INDUSTRY'S JACK-OF-ALL TRADES

Also Works On Inside Cut-Out Openings!

Serving a swiftly-growing number of America's important Defense Contractors. For that troublesome grinding or finishing job, try the Burring Machine. If it doesn't help you, it won't cost you a cent! There is not one industrial plant in America where this machine — somewhere along the line — cannot be helpful. Toolroom, template department, production line, or elsewhere — it will find its place. Try it at our expense. Immediate delivery in most instances.

TYPICAL BURRING MACHINE JOBS

De-burring stampings and other small parts. Removing "flash" from forgings and die-castings. Grinding cutters and tools. Cleaning up irregular edges. Smoothing and polishing metals of all kinds.

MEAD SPECIALTIES CO.
DEPT. 113-MX
15 S. MARKET STREET
CHICAGO (6)

Plastics that do not come up to standard are a black eye in any shop. Soft centers, off colors and warping are usually the fault of incorrect molding temperatures. Surface temperatures are too important to be guessed at. With new powders and new operators, you need dependable mold pyrometers now, more than ever before. The CAMBRIDGE Mold Pyrometer is an accurate, quick-acting, sturdy instrument that enables the operator to instantly determine the exact surface temperature of each mold cavity.

Combination and Single Purpose Instruments

BUY WAR BONDS

Cambridge Instrument Co., Inc.
3732 Grand Central Terminal, New York City

CAMBRIDGE
Mold—Surface—Needle
PYROMETERS

Bulletin 194—S gives details of these instruments. They help save money and make better plastics.

Pressures as high as 6000 lb. per sq. in. are
EASY TO HANDLE
via an

ATLAS Type "E"
High Pressure Reducing Valve

Despite the high pressure there is no shock. And it makes no difference whether you are using water, oil, or air.

We feature this High Pressure Valve because it is comparatively new. It is already being widely used in plastics plants, but we find that many executives are still unacquainted with it.

Here, for instance are the outstanding features:

Forged Steel body. Internal metal parts entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

For other ATLAS plastics plant products see the partial list in our ad in the January issue of MODERN PLASTICS.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
277 South Street, Newark, N. J.
Representatives in Principal Cities

The third in a series of plastics applications.

"MIGHTY MITE" OF THE COCKPIT

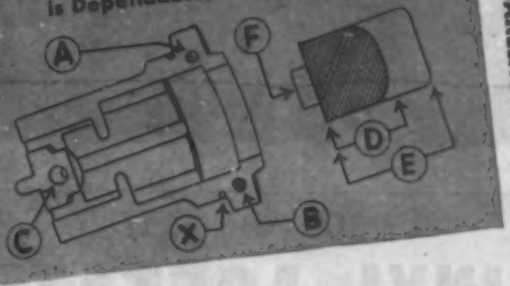
SKILLFULLY the pilot maneuvers his enemy into the center of his ringsight. His tensed finger bears down on this tiny switch and the fury of snarling death is unleashed from his blazing guns —fulfilling the destiny of another Nazi or Nip.

• • •

This war in the sky moves with incredible speed. A pilot has only a second to fire his guns. Failure of his gun-fire control switch might cost him his life.

Mindful of this responsibility, we are grateful that our 27 years of experience enabled us to design and engineer the intricate mold for this important part.

Gun-Fire Control Switch of Bakelite BM-120 Is Dependable, Easy Working



BAKELITE BM-120 Gun-Fire control Switch

MOLD DESIGN
This small part (less than 1" long) was compression molded in 2 half-sections. To insure perfect alignment when assembling a minute ball and socket (A & B) were placed on facing surfaces. Hole (C) is provided for a rivet. A 20-cavity mold was designed to mold 10 complete switches in every operation. A spring is placed around collar (X) to hold top of switch together. Buttons were provided in 2 sizes (D & E) in several different colors. The small buttons (D) were molded in an 8-cavity mold . . . large buttons (E) in a 4-cavicy mold. Note insert (F) for attaching buttons to inner mechanism. The only finishing was wire brushing the joining surfaces.

TOLERANCES
Exceptionally close dimensional tolerances were required to insure ease of assembly and avoid unnecessary wear on moving surfaces when the part was in use. Tolerances of the narrow wall sections and pistons on the inside curved surfaces had to be held to + or — .002. Outside diameter tolerances for the buttons . . . + .000 or — .004.

MOLDING MATERIAL
Bakelite BM-120. A thermosetting phenolic material, widely used for electrical and mechanical applications, was chosen because of its free flowing characteristic which was necessary in a part of this small intricate shape.

Your request will bring additional copies of file cards No. 1, 2 and 3 as a reference for plastics applications.

AICO

Aico PRECISION MOLDING

AMERICAN INSULATOR CORPORATION, New Freedom, Pa.
Sales Offices: BOSTON · BRIDGEPORT · BUFFALO · CHATTANOOGA
CLEVELAND · DETROIT · NEW YORK · PHILADELPHIA

COTTON FABRICS

FOR REINFORCING

PLASTICS

★

J. H. LANE & CO., Inc.

250 W. 57th St. · New York 19, N. Y.

STANDARD TOOL COMPANY

75 WATER STREET — LEOMINSTER, MASS.

1911 — 1943

Thirty-two years experience in **Plastics** enables us to aid plastic manufacturers in serving their Government more efficiently.

Our experienced engineering department offers the latest and best design in the advancement and development of Plastics—Molds and Equipment.

Lester Injection Molding Machines—New England Representatives. The latest and largest—**4-ounce to 22-ounce.**

Conservation of vital materials calls for efficient **Scrap Grinders**—Ball & Jewell New England Representatives.

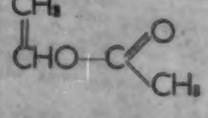
Plastic Material Dryer—Parks Standard—U. S. Agents. An efficient Dryer of all materials, scientifically developed for this purpose alone.

Gages—Jigs—Fixtures. Because of our highly skilled personnel and modern equipment, we are serving the Government in the manufacture of these precision tools.

UNPOLYMERIZED

VINYL ACETATE

(STABILIZED)



Purity 99.5% Boiling Range 71.8° to 73° C.

Vinyl Acetate can be polymerized to form resins with exceptional bonding qualities for wood, glass, metal and fiber.

Containers:—

410 lb. drums; 62,500 lb. tank cars

For further information write to

NIACET

CHEMICALS CORPORATION

4740 PINE AVE — NIAGARA FALLS, N. Y.

ORGANIC PEROXIDES

CATALYSTS FOR POLYMERIZATIONS
DRYING ACCELERATORS · OXIDATION AGENTS · BLEACHING AGENTS

LUCIDOL®
(BENZOYL PEROXIDE)

LUPERCO®
(PEROXIDE COMPOUNDS)

ALPEROX®C
(TECHNICAL LAUROYL PEROXIDE)

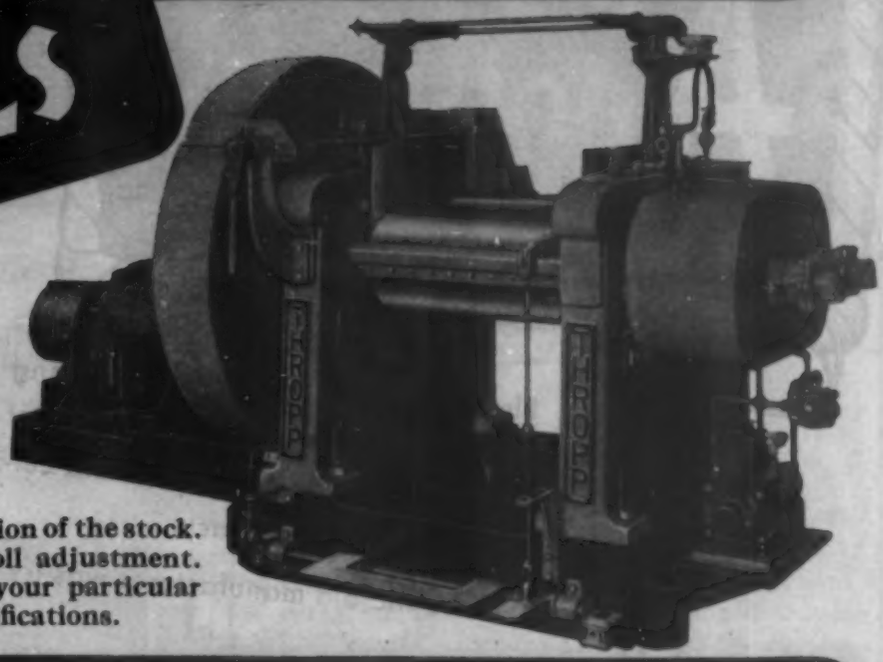
SPECIAL ORGANIC PEROXIDES

® REGISTERED TRADEMARK

LUCIDOL CORPORATION

BUFFALO (5) N. Y.

New! HEAVY DUTY MILLS for Tough Plastics



Size 14" & 14" x 30"

For mixing, grinding, and sheeting plastics and for blending colors. Mill illustrated is equipped with flood lubrication and oil seal Klosures to prevent oil contamination of the stock. Hand operated, micrometer roll adjustment. Mills can be custom built to your particular requirements. Write for specifications.

WM. R. THROPP & SONS CO., Trenton, New Jersey

PRODUCTION AND LABORATORY MILLS FOR PLASTICS

THE FINGER-TIP CONTROLLED

FOREDOM FLEXIBLE SHAFT MACHINES

Are As Versatile and Adaptable As Plastics Themselves

Model illustrated is Foredom No. 340. Comes with either foot or hand-operated rheostat at $45.70. (Available with suspension-type motor. No. 240, at $43.20, including foot rheostat.) Other models as low as $23.50.

The finger-tip controlled Foredom gets into many places ordinarily inaccessible and does many jobs quickly and efficiently that otherwise require expensive, time-consuming hand labor. The versatility of Foredom Flexible Shaft Machines is matched only by the versatility of plastics themselves. Foredom's wide-range of easily interchanged accessories and choice of four different handpieces, means that every Foredom Machine is ready at a moment's notice to rout, carve, trim, finish, mill, drill, slot, bore—or perform many other services in repairing and maintaining heavier equipment, touching up molds, or working on plastics themselves.

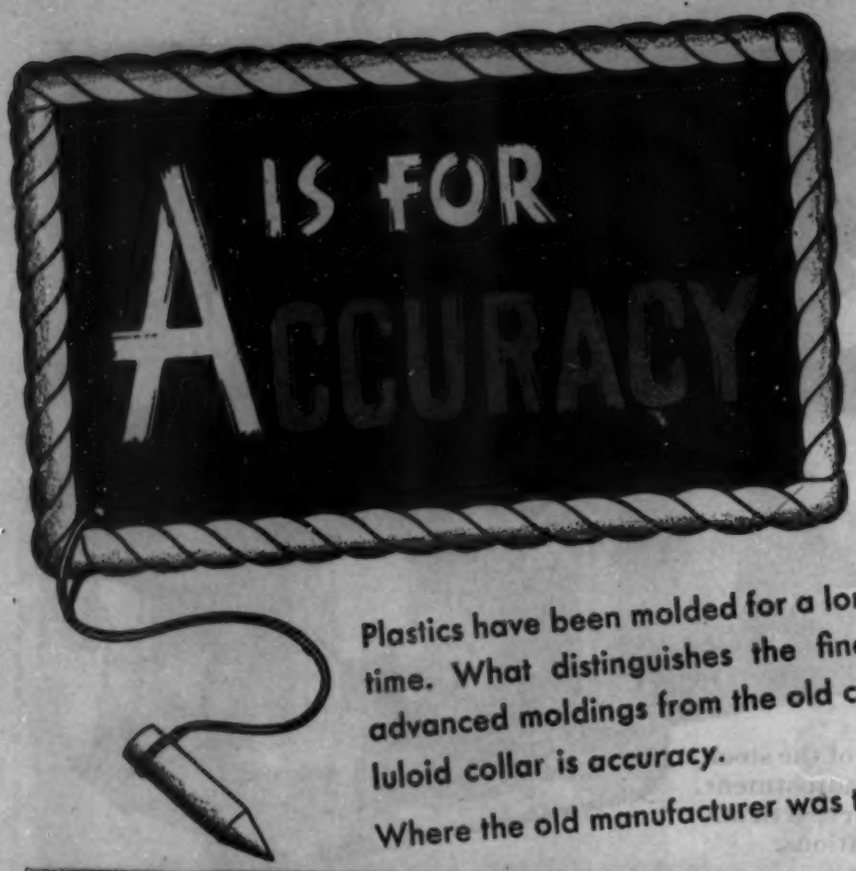
Finger-tip control . . . . . plus a wide variety of accessories . . . . . means precision workmanship, unlimited adaptability.

A copy of our new Catalog No. 425, showing our complete line of FOREDOM Flexible Shaft Machines and Accessories will be sent you on request.

Grinding, cleaning, finishing, polishing and correcting molds

Finishing and touching up plastic molded parts

FOREDOM ELECTRIC CO. ESTABLISHED SINCE 1922 · 27 PARK PLACE, NEW YORK, N. Y.



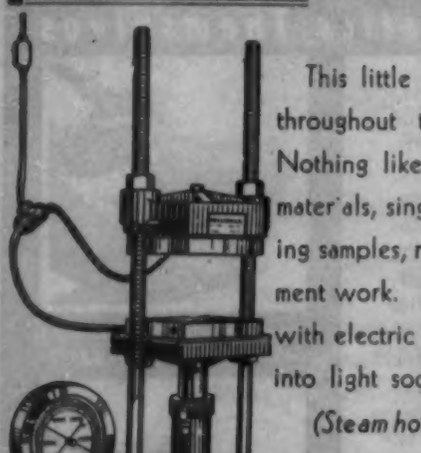
Plastics have been molded for a long time. What distinguishes the finest advanced moldings from the old celluloid collar is accuracy.

Where the old manufacturer was trying to fit the human neck, we've taken plastics right in with the metals to meet precise measurements as functional working parts. We measure plastics in thousandths of an inch, and we make them to fit.

For precision war requirements, and for post-war accuracy in molded plastics, remember the company that specializes in accuracy.

ACCURATE MOLDING CORPORATION
116 NASSAU STREET . . BROOKLYN, NEW YORK

The CARVER LABORATORY PRESS
for Plastics Research



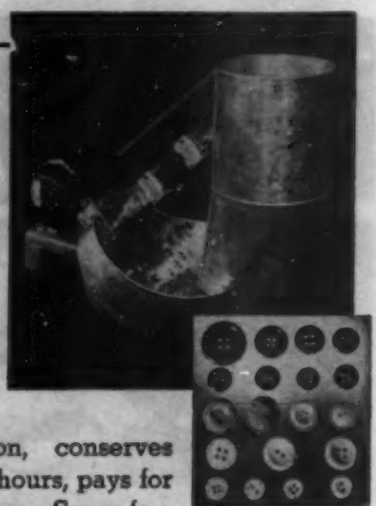
This little press is well known throughout the plastics industry. Nothing like it for testing plastic materials, single cavity molds, making samples, research and development work. Self-contained, fitted with electric hot plates—just plug into light socket and go to work. *(Steam hot plates if desired.)*

Write for Catalog.

FRED S. CARVER
HYDRAULIC EQUIPMENT
343 Hudson St. New York, 14, N. Y.

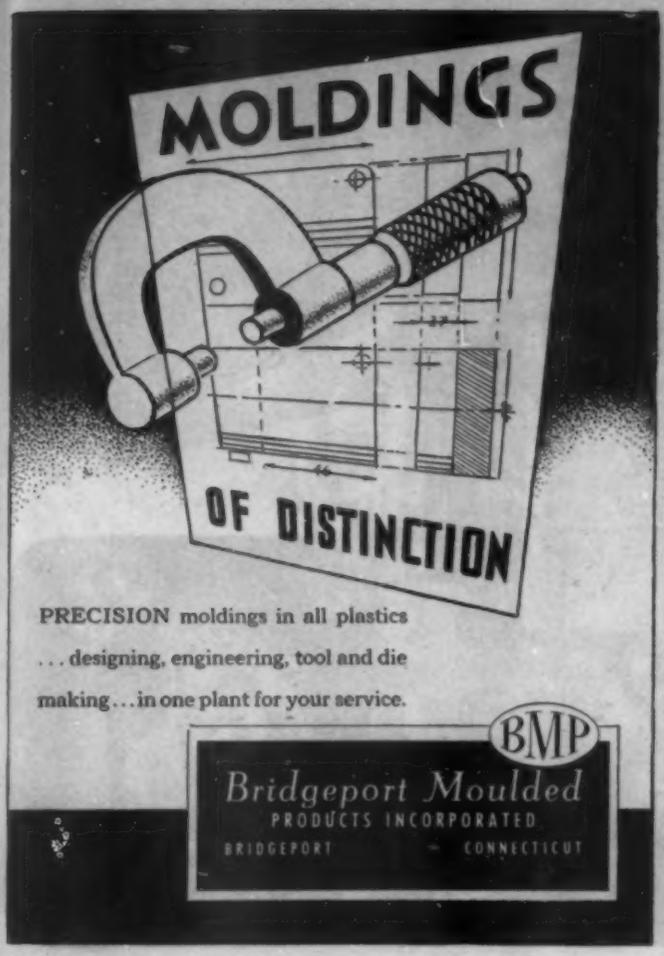
COMPLETELY AUTOMATIC BUTTON FINISHING

Punches Fins
Cleans Holes



SPEEDS production, conserves manpower and manhours, pays for self in very short time. Saves factory space. 3 models available: Model *S* accepts sizes 12 to 34; Model *SP* accepts sizes 36 to 50; Model *SX* accepts sizes 12 to 50. Production up to 450 per minute.

BullOndeX
Corporation
386 Fourth Avenue New York, N. Y.



PRECISION moldings in all plastics ... designing, engineering, tool and die making... in one plant for your service.

BMP
Bridgeport Moulded
PRODUCTS INCORPORATED
BRIDGEPORT – CONNECTICUT

CUT MOLDING TIME 50% with DESPATCH Forced Draft Ovens

Drawer type Despatch plastic pre-heating oven; thermostat control. To 300° F. Easy to use. Guaranteed.

An Economical Way to Boost Production!

You save at least 50% in molding time by *first* pre-heating your plastic pre-forms, molds, sheets or powders in a Despatch forced draft oven. Smooth, uniform heat penetrates material and eliminates time-wasting delay in press operation. An easy, *low-cost* short-cut which saves time and greatly improves quality of your production.

GIVES THESE ADDED BENEFITS

Improves Flow of plastic; **Gives Better Finish** as cure is faster and stiffer materials may be used; **Increases Strength** chemically, electrically, mechanically; **Cuts Rejects,** lowering shrinkage and reducing stresses; also avoids streaking.

WRITE FOR DETAILS TODAY!

DESPATCH OVEN COMPANY MINNEAPOLIS

DoALL Zephyr

...the Modern "Minute Man"

Developed because of today's demands for more cutting speed, and to make every minute count. Weighs 2500 pounds—a tower of rigidity and strength to back up smooth, precision speeds of 1250 to 5,000 f.p.m. (up to 10,000 f.p.m. when required).

Operator above is "miking" thickness of Rock Maple sawed on the Zephyr.

The Zephyr is equipped with a Job Selector, a true guide to correct saw and speed for hundreds of woods, plastics, alloys, metals, etc.

Here are some sawing speeds per minute you'll get with the DoALL Zephyr.

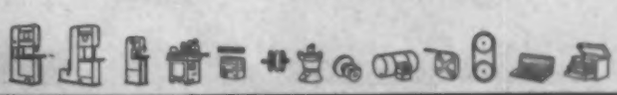
ROCK MAPLE 380 square inches

MAHOGANY 432 square inches

MAGNESIUM 120 square inches

BRAKE LINING MATERIAL 28½ linear inches

Write for interesting literature today



DoALL

OFFICES IN PRINCIPAL CITIES

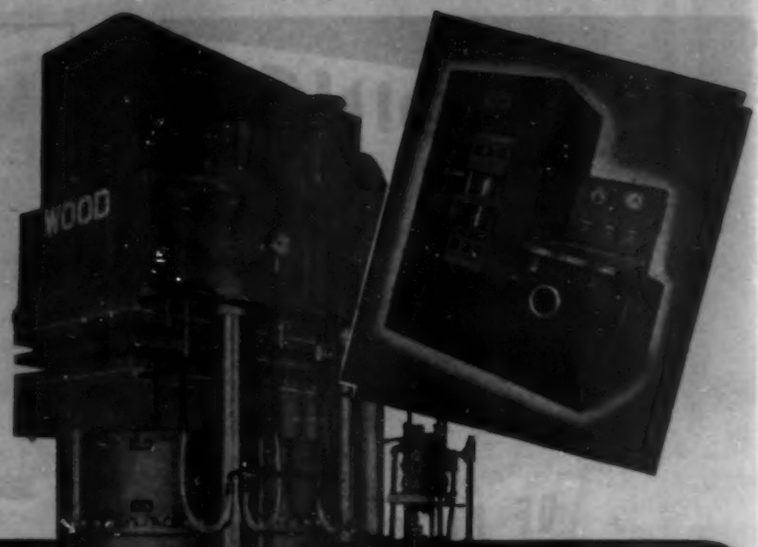
ZEPHYR
Made by Continental Machines, Inc.
1330 S. Washington Ave. Minneapolis 4, Minn.

INDUSTRY'S NEW SET OF TOOLS SOLD AND SERVICED BY 34 DoALL OFFICES

HYDRAULIC PRESSES FOR EVERY NEED . . .

From small laboratory presses to massive production units, the R. D. Wood Company designs and builds hydraulic presses to meet every requirement. Typical of variety are the 570-ton Laboratory Press with electrically heated platens shown in inset, and the 3450-ton Hard Board Press with steam heated platens.

The Wood engineering department stands ready at all times for consultation on your hydraulic press problems.



R. D. WOOD CO.

PHILADELPHIA · PENNSYLVANIA

HYDRAULIC PRESSES FOR EVERY PURPOSE

DO YOU KNOW . . .

All of the Advantages of Infra-Red Ray Drying with **NALCO DRITHERM**

Carbon Filament Lamps?

Remove Moisture from Plastics Quickly and Cheaply with Nalco Infra-Red Lamps

Use Nalco Dritherm Lamps for efficient results . . . available in Inside-Silvered (self-reflecting) or clear glass types.

Learn all of the advantages of the Infra-Red process for plastic dehydration.

Write for your free copy of "Drying Problems Made Easy" today.

Exterior of Infra-Red Conveyor Belt Tunnel for removing moisture from plastic material prior to molding.

Sides dropped to show arrangement of Infra-Red light bank and materials passing under light conveyor belt.

North American Electric Lamp Co.

1012 Tyler Street St. Louis 6, Missouri

NALCO

Protective

Reflective

PEARL ESSENCE

Intensifies Luminescence

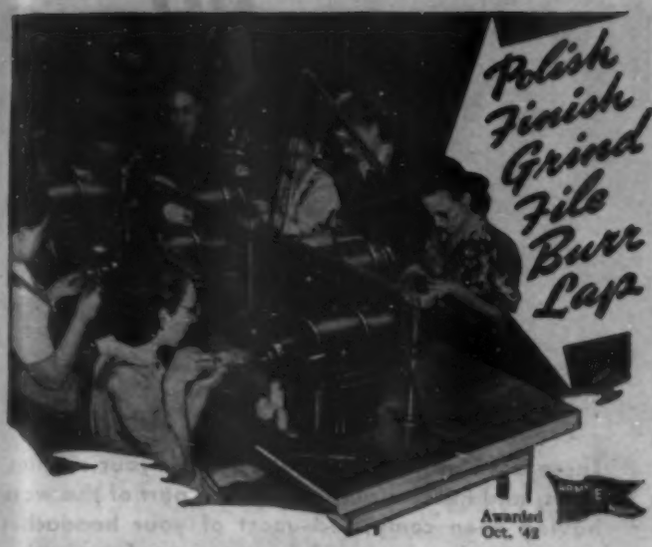
SEE U. S. P. 2,318,089

Non-Priority Unlimited Quantities

MEARLMAID PEARL ESSENCE

THE MEARL CORPORATION

153 Waverly Place New York, N. Y.



DE-BURR SMALL PARTS

speedier and more accurately with Schauer Speed Lathes—time savers in any plant. A type to meet your individual requirements—hand or foot operated, air operated, variable speed. Write for Cat. 420.

Schauer MACHINE COMPANY — ORIGINATORS OF TODAY'S SPEED LATHES

2077 Reading Rd. Cincinnati 2, Ohio

COTTON DUCKS

for

Laminators and Molders

Our Southern mills have made high-tensile cotton fabrics for the Plastics Industry for fifteen years and specialty industrial cotton textiles for over thirty-five years. Our experienced development and production facilities are available to the Plastics trade, limited only by the requirements of our armed forces.

Curran & Barry

320 BROADWAY NEW YORK CITY.

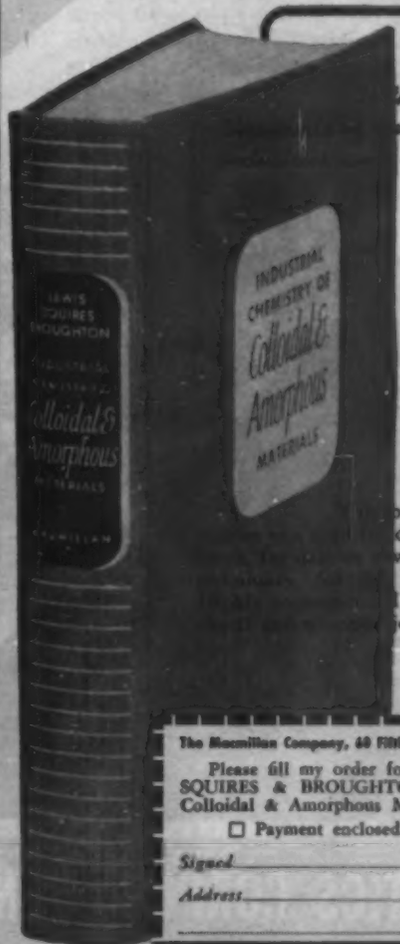
Stamp NAMES • DESIGNS TRADEMARKS

In Gold, Silver, Colors on Plastic Products

Precision stampings—positive, clean-cut, enduring—can now be done with ordinary girl operators at production speeds up to 1,000 pieces per hour. Write for catalogue, or submit your stamping problems.

Kingsley GOLD STAMPING MACHINE CO.

★ HOLLYWOOD, CALIFORNIA ★



This famous book is the valued stand-by of workers in the chemical research laboratories.

It is the only up-to-date, authoritative treatment in one volume of *both* the theory *and* the industrial applications of colloidal chemistry. It explains the chemical constitution, industrial processing, and uses of all kinds of plastics and synthetic materials, glass, paints and oils, adhesives, detergents, resins, absorbents, etc.

book gives you the infor- developmental work of all w materials and processing latest scientific findings. by all the trade, profes- journals.

The demand for this book is so great that we have difficulty keeping stock of it. We urge you to order NOW the copies you want.

The Macmillan Company, 60 Fifth Avenue, New York 11, N. Y.

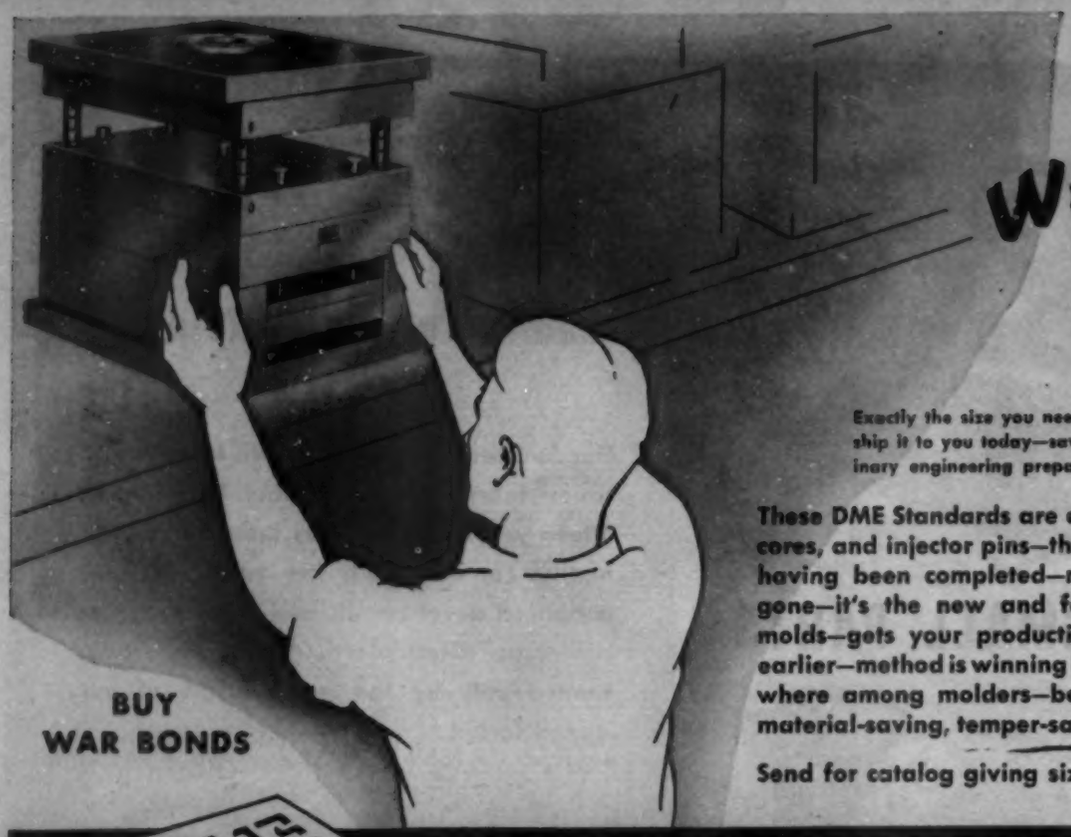
Please fill my order for_____copies of LEWIS, SQUIRES & BROUGHTON: Industrial Chemistry of Colloidal & Amorphous Materials. ($6.00)

☐ Payment enclosed. ☐ Please bill me.

Signed_____

Address_____

MP



NO WAITING

HERE'S THE MOLD BASE YOU WANT

Exactly the size you need. We can take it out of stock—ship it to you today—save you days and days of preliminary engineering preparation.

These DME Standards are already for your cavities, cores, and injector pins—the major part of the work having been completed—most of your headaches gone—it's the new and faster way of preparing molds—gets your production started 6 or 7 days earlier—method is winning instant acceptance everywhere among molders—because it is time-saving, material-saving, temper-saving.

Send for catalog giving sizes, features, and prices.

DETROIT MOLD ENGINEERING COMPANY
4837 WOODWARD AVENUE • DETROIT, MICHIGAN
NEW YORK OFFICE – 475 Fifth Ave. – Telephone Murray Hill 3-5108

Ideal

A SYMBOL OF FINEST CRAFTSMANSHIP IN INJECTION AND EXTRUSION MOLDING

THAT LITTLE "*Extra*" IN EXTRUSION MOLDING

WE HAVE SOLVED many injection molding problems. They were hard nuts to crack and involved the production of critical plastic items requiring absolute precision in manufacture.

THIS UNUSUAL "KNOW HOW" applies to extrusion molding as well. We're equipped to produce extruded rods, tubes, strips of varying lengths and sizes . . . with our customary attention to accuracy and detail.

THIS IS A GOOD TIME to start planning for the time when plastic materials are available once more for civilian use.

IDEAL PLASTICS CORPORATION
A DIVISION OF IDEAL NOVELTY & TOY CO., INC
23-10 43rd AVE., LONG ISLAND CITY, N. Y.

CONTRACT AND CUSTOM
PLASTICS MOLDING
FOR THE TRADE

INJECTION MOLDING
A SPECIALTY
•
Ask us for QUOTATIONS on your requirements. No obligation.
WRITE TODAY

S. S. WHITE
The S. S. White Dental Mfg. Co.
INDUSTRIAL DIVISION
PLASTICS DEPARTMENT M
10 East 40th St., New York 16, N. Y.

INTERPHONE
COMMUNICATION EQUIPMENT

NOW IN PRODUCTION:

CD-318-A	JK-48	PL-68	PE-86
CD-307-A	PL-47	"A" Plug	SW-141
CD-874	PL-54	BC-366	JB-47
JK-26	PL-55	BC-347-C	

Your inquiry is invited on these and other Inter-communication Equipment

TRAVLER KARENOLA
RADIO AND TELEVISION CORPORATION
1042 W. VAN BUREN ST., CHICAGO 7, ILL.

CHART
PLASTIC'S FUTURE
from this
STARTLING PREVIEW

To be among the first to see a startling new chart of industry—visit the 19th Exposition of Chemical Industries at New York's Madison Square Garden, December 6–11.

As a summary of current achievements in chemistry and engineering and a preview of the future, this Exposition deserves the attention of every chemist, engineer and production executive in the plastics industry. From what you can see . . . from what you can hear when you talk with the technical experts in attendance at exhibits . . . may come the answers to many otherwise baffling problems. It's the right place to seek the "know-how" you need to carry on in these days of regulations, allocations, Government orders and other necessary wartime handicaps.

Marvels in the production of new substances by chemical methods with their counterpart in special processing equipment are still necessarily in part a war secret. Many details that may be revealed however, including not a few bearing on post-war plans, will form a leading interest at this year's Exposition of Chemical Industries.

Important decisions regarding the post-war activities of manufacturers may be made as a result of this Exposition. Much of the information to be disclosed reflects either the creation of new industries and their products, or the conversion of existing plants to new uses—to help win the war now, to help rebuild the world after Victory has been won.

To be among the first to see the startling new chart of industry, visit this year's Chemical Exposition—and bring your associates.

19th EXPOSITION OF CHEMICAL INDUSTRIES
MADISON SQUARE GARDEN • NEW YORK
DEC. 6-11, 1943
Managed by International Exposition Co.

Plastics SCRAP WILL HELP WIN THIS WAR

We specialize in the reworking of
rejected molded parts
obsolete molding powders
or molding scrap
into solid colors of a good molding powder
in any desired flow

A. BAMBERGER
Plastics Molding Materials
109 SOUTH 5th STREET BROOKLYN, N. Y.
Cable: Chemprod — Telephone: EVergreen 7-3887

ACCEPTED STANDARD for Testing Plastic Surfaces

Taber ABRASER

● The Taber Abraser provides the required constant tests to accurately compare and evaluate plastic surface wear qualities. Scientific wear action by two rotating "Calibrase" wheels against a 4" specimen mounted on revolving turntable, is recorded in terms of "wear cycles" on built-in counter. Also surface resistance to digs and scrapes and damage other than normal wear can be quickly and accurately computed with Shear-hardness Attachment. Write for Bulletin 4012 NOW.

TABER INSTRUMENT CORPORATION
111MO GOUNDRY STREET, NORTH TONAWANDA, N. Y.
Designers and Builders of Scientific and Precision Apparatus

CUTTING OUT Gun Slots in Power Turrets

★

***another job for the* CARTER PORTABLE ROUTER**

Transparent plastic "blisters" that house gun turrets are hard to handle on stationary machines because of their curved shape and their size. Cutting out the gun slots would ordinarily require complex holding fixtures, but the job is greatly simplified by using a *portable* Router, the Carter R4.

With ample power for fast cutting, it speeds up trimming and fitting all types of plastic shapes. Used for rabbeting, chamfering, and similar cuts, its high speed (18,000 R.P.M.) assures a smooth finish, snug fits. Light in weight (4¾ lbs.), it can be easily operated by women workers

Standard or special attachments permit adaptation of Carter Routers for many jobs that are hard, slow work with other tools. Write for complete specifications, and recommendations for special applications where required. R. L. CARTER DIV., The Stanley Works, 175 Elm St., New Britain, Conn.

Carter R4 Router

CARTER TIME-SAVING TOOLS

Include K&J *in your* POST WAR PLANNING

C.E.D.* is urging every business concern, large or small to lay plans NOW for business after the war—plans that will, *increase* production rather than lessen it. JOBS will be needed for millions of men and women, if we are to retain our American way of life. Investigate NOW the facilities here at Kuhn and Jacob for

HIGH GRADE PLASTIC MOLDING

Plan to make use of our invaluable fund of experience, our modern equipment, our efficient service. When the war began the slogan was, "Act! It is later than you think!" Our advice *now* is, "PLAN! IT MAY BE SOONER THAN YOU THINK!"

WIN THE WAR FIRST, OF COURSE

Right now our entire production is devoted to war orders, and will continue to be till the day of VICTORY.

Kuhn & Jacob
MOLDING and TOOL CO.
1204 Southard St., Trenton 8, N. J.
New York Office, PEnn 6-0346

* Committee for Economic Development

MIRACLE ADHESIVE

bonds · joins · fastens
RIGID PLASTICS
Glass · Metals · Wood
without screws, nails, bolts, shields or clips

CONSULT US IF YOU HAVE A BONDING PROBLEM

MIRACLE ADHESIVES CORP. 261 Fabyan Place, Newark, N. J.

Our Job . . . Today
is to help
WIN THIS WAR

100% Production for Our Armed Forces

We know we are doing our job—and doing it well. Every single Michigan Molded employee is giving the best he's got. Each knows that less than 100% effort is not enough.

However, our few relaxing moments are devoted to future markets and the many entirely new products we will be making in another all-out effort to help maintain the peace.

MICHIGAN MOLDED PLASTICS, INC.
Dexter, Michigan

CUSTOM M MOLDERS

100% PLANNING FOR FUTURE MARKETS

MacRae's
Blue Book
Directory advertising helps win the war of business. MacRae's Blue Book reaches the "blue chip" buyers throughout industrial America. For advertising rates write
MacRae's Blue Book
A DIRECTORY OF AMERICAN INDUSTRY
18 E. HURON STREET • CHICAGO
OFFICES IN PRINCIPAL CITIES

When the decision specifies Precision

...write, telegraph, or 'phone

ELECTRIX

for: PLASTIC MOLDS
• BLANKING DIES
• LAMINATION DIES
• 33 Types of GAGES
• FORM TOOLS
• FIXTURES
• JIGS

OUR EQUIPMENT
and facilities, which are among the finest, are ideally suited to quantity production of small precision parts. Inquiries receive our prompt and careful attention.

NO-GO PRECISION AUTHENTICATED

ELECTRIX *Corporation*

Peace-time engineers of soft-rubber connectors, sold exclusively through U. S. RUBBER COMPANY

158 MIDDLE STREET • PAWTUCKET, R. I.

Make Plans Now . . . for the coming **PLASTIC ERA**

Consult **ROGAN**

Here at Rogan, seasoned engineers are ready and willing to assist you in determining your post-war *Plastic* requirements.

Whether your peacetime products are to include electronic equipment, electrical appliances, stoves or what have you, the Rogan Organization will gladly provide cost-free advice on all phases of plastic production.

Send Us Your Specifications Today!

ROGAN BROTHERS

Compression Molders and Branders of Plastics

2005 So. Michigan Avenue Chicago, Illinois

Wanted!

WILL PAY CASH-
ANY QUANTITY

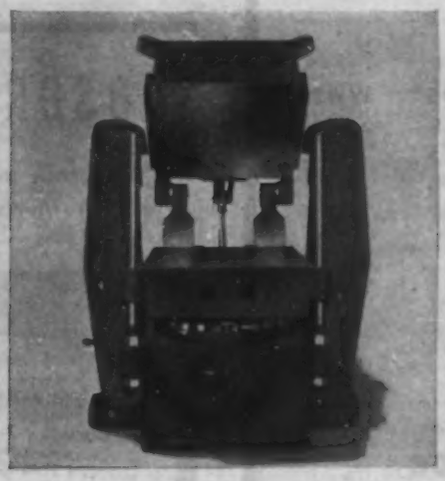
CELLULOSE ACETATE
POLYSTYRENE
BEETLE
BAKELITE
AND SCRAP

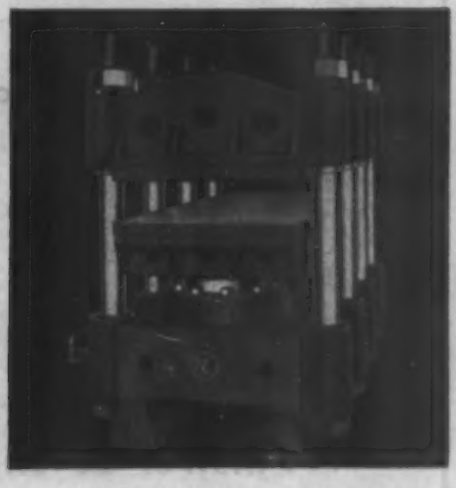
TO MOULDERS: We are prepared to place quantity orders for long and continuous runs of lipstick containers, rouge boxes, etc., to be made from our own moulds.

HARRY BRODER

CREATOR AND DISTRIBUTOR OF COSMETIC CONTAINERS

5 EAST 47th STREET, NEW YORK, N. Y. • PL 8-0520





PRESSES FOR RUBBER AND PLASTICS

From the smallest laboratory press to the largest that your production requires defines the N.E. Line of hydraulic press equipment. Our modern steel foundries and machine shops make it possible for us to build to your exacting specifications entirely under one control—one responsibility. Consult N.E. engineers for any war application of specialized hydraulic presses. Write for bulletin H.P.

Write for these booklets

NATIONAL-ERIE CORPORATION
ERIE, PA. U. S. A.

MACHINE TOOL SALES REPRESENTATIVE

with

agents throughout the world interested in securing line of Injection Moulding machines and accessories for the plastics trade, lining up post war business.

●

Answer at once

to

BOX 822

●

NO GREMLIN

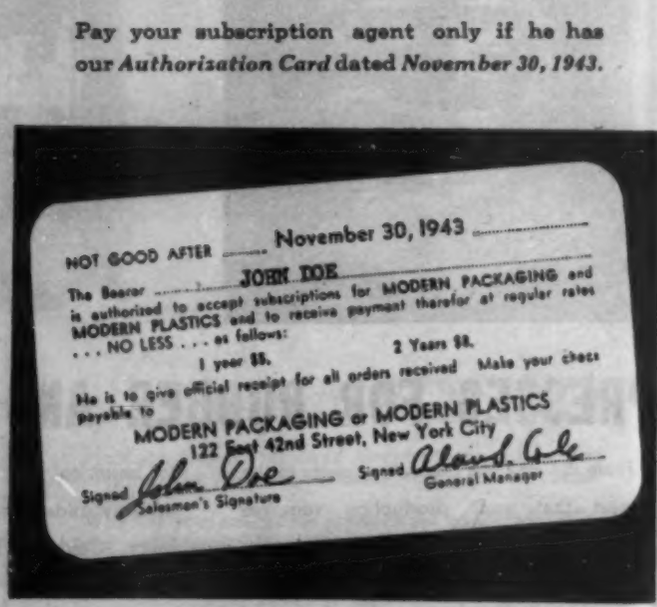
IMP is no gremlin. He belongs to the helpful family of plastics molders. His specialty is automatic controlled molding of plastic materials and he is ready to serve you as he is helping our Armed Forces. IMP is experienced in compression molding and laminating.

INTERNATIONAL MOLDED PLASTICS, INC.

4383 W. 35th St. Florida 8010 Cleveland, Ohio

SUBSCRIPTION WARNING

Pay your subscription agent only if he has our *Authorization Card* dated *November 30, 1943.*


NOT GOOD AFTER ..... November 30, 1943 .....

The Bearer ..... JOHN DOE .....

is authorized to accept subscriptions for MODERN PACKAGING and MODERN PLASTICS and to receive payment therefor at regular rates . . . NO LESS . . . as follows:

1 year $5. 2 Years $8.

He is to give official receipt for all orders received. Make your checks payable to

MODERN PACKAGING or MODERN PLASTICS
122 East 42nd Street, New York City

Signed John Doe Salesman's Signature

Signed Alan S. Cole General Manager

Make checks payable to

MODERN PLASTICS

Chanin Building, 122 E. 42nd St., New York, N. Y.

All classified advertising payable in advance of publication. Minimum, $5.00 (up to 60 words); in border, $10.00 per inch.

Classified Advertisements

For further information address Classified Advertising Dept. MODERN PLASTICS 122 East 42nd St., New York, N. Y.

HAVE $5,000,000.00 WORTH OF INJECTION PLASTIC MOLDING BUSINESS TO PLACE WITH RELIABLE MOLDER. PREFER ONE WITH OWN TOOL ROOM OR EXCELLENT TOOL MAKER CONNECTION. IF NECESSARY WILL TAKE INTEREST IN BUSINESS OR WILL PURCHASE PLANT OUTRIGHT. MUST BE LOCATED IN EAST OR MIDDLE WEST.

GIVE FULL PARTICULARS IN ANSWERING, STATING NUMBER OF INJECTION MACHINES, MAKES AND SIZES. Reply Box 879, Modern Plastics.

ORGANIC DEVELOPMENT CHEMIST: An excellent opportunity for Organic Chemist or Chemical Engineer with organic background and M.A. or Ph.D. degree to do original development in application work in field of synthetic resins. Must have initiative, imagination, and be able to do creative work. State experience and salary desired. Reply Box 833, Modern Plastics.

URGENT

NEED ACETATE MOLDERS WITH FACILITIES FOR MOLDING FRAMES FOR SUN GLASSES.

Large Quantities on
High Priority Rating
Box No. 865, Modern Plastics

WANTED: PLASTIC SCRAP OR REJECTS in any form, Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Acrylic and Vinyl Resin materials. Submit samples and details of quantities, grades and color for our quotations. Reply Box 508, Modern Plastics.

FOR SALE: 2 W. S. Hydraulic Presses, 12" x 12", 7½" ram; 14" x 10", with 8" ram; W. S. Hydro-Pneumatic Accumulator. Robertson 13" x 16", 8" ram. 400 Ton Hydraulic Extrusion Press. 80 Ton Hydr. Baler. W. & P. 150 gal. jacketed Mixer. Large stocks of Hydraulic Presses, Pumps, and Accumulators, Mixers, Grinders, Pulverizers, Gas Boilers, etc. Send us your inquiries. We also buy your surplus machinery. Stein Equipment Co., 426 Broome St., New York City.

FOR SALE: 4—Farrel Birmingham Hydraulic Presses, 24 x 24, with 12" ram; 1—W. S. 15" x 18" Hydraulic Press, 10" ram; 1—14" x 24" Press, 9" ram; 9—24" x 55" steel cored Heating Platens; 4—W. & P. Mixers; 1—Elms Hydraulic Pump, 6.5 GPM at 7500# pressure PSI; 4—Semi-Automatic, 100 Ton Hydraulic Presses, platen area 20" x 36"; 1—Watson Stillman Hydro-Accumulator, 5½" ram; Adamson 6" Tuber; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box No. 447, Modern Plastics.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

FOR SALE: One Southwark 225 ton Inverted Press with pushbacks. Reply Box 512, Modern Plastics.

WANTED

Man with minimum of one year experience in molding room, or engineering department of injection molding concern, to do sales work on salary basis, for an established Mid-Western concern.

Men with plastic sales experience may also apply. Box 862, Modern Plastics.

WANTED

Salesman with past experience with good injection molding concern, wanted to travel as direct representative for reputable established Mid-western concern, good salary and opportunities for advancement.

Box 863, Modern Plastics

Wanted: Men for technical sales work in plastics; experience in phenolic resins, preferably specialty grinding wheel, plywood or others; or in selling thermoplastic moulding materials, injection moulding experience desirable. If presently employed in an essential activity, Statement of Availability must accompany application. Box 867, Modern Plastics.

WANTED

December, 1943

Plastics parts and material inspector for expanding middle western molder.

Must be familiar with army, navy and air corps specifications and reports. Industrial close tolerances experience desirable.

This position applies to post war as well as now. State age, draft status, salary expected. Do not apply if already in an essential capacity. Reply Box 869, Modern Plastics

Wanted

District Managers

Important, long-established manufacturer of laminated plastics widely used in industry (aircraft, electrical, communications, etc.) seeks plastic-experienced, high calibre men to establish and manage district offices in Chicago, Buffalo-Cleveland, Indianapolis-Cincinnati areas. Please send complete information, which will be held in strict confidence. Our organization knows of this expansion of sales activity.

Address:

"Plastics Manager", G. M. Basford Co., Leader Bldg.,

Cleveland, Ohio

WANTED

January, 1944

Production Supervisor as assistant to production manager for growing middle west custom molder. Must have full knowledge of thermosetting resins and some thermoplastic. Experience in all types of molds and transfer molding essential. Must have working knowledge of hydraulic self-contained presses and high pressure boilers.

Former experience in molding of industrial parts to close tolerances desirable, and ability to carry out production schedules, supervising installation of tools and cycling of jobs for production.

This plant producing at 100% capacity for war production. This job now held by man being called into service. However, this position and plant has definite possibilities in post war period for the right party. Write regarding experience, draft status, age, and salary expected. Kindly enclose picture. Do not write if already engaged in an essential occupation. Reply Box 870, Modern Plastics.

Canadian Agency wanted by man 35 years of age who can organize own sales force either for present or post-war period. Has excellent record selling specialized line to both retail and large industrial concerns. Reply Box 871, Modern Plastics.

SALES EXECUTIVE

with creative ability and excellent connections among Drug-Notion-Stationery and Hardware jobbers, also users of Premiums and Specialties interested in establishing connection with progressive plastic concern. Purpose to create new idea and to develop new field now and for post-war period.

Reply Box 872 Modern Plastics

Successful artist, designer, colorist, desires to enter plastics field where his ability can be used in appearance design. Can design molds. Not afraid of manual labor. Reply Box 873, Modern Plastics.

This creative producer can be of value to you. I have technical plastic training, plus 25 years sales and marketing experience, selling to manufacturers, wholesalers and government contractors. University graduate. Draft exempt. Reply Box 874, Modern Plastics.

NON ESSENTIAL ITEMS for after war use. We will buy moulds for toys and novelties. Reply Box 827, Modern Plastics.

The Sixty-Four Dollar Question.

What do you have to offer an Engineering student at the Plastics Industrial Technical Institute who has completed seven months of the course and would consider devoting the balance of the course along lines that would be of the most benefit to you? Correspondence invited as to age, character and draft status.

Reply Box 877 Modern Plastics.

WANTED—man to supervise new laminated division of an established plastics concern. Must have practical experience in handling various laminated plastics operations. Reply Box 878, Modern Plastics.

Wanted 400 ton 60" x 60" or there about 84" day-light or more, rods 5" diameter or more, must have 36" stroke, 5000 P.S.I. pump 5 to 6 gal., per min, accumulator 3000 lbs, P.S.I. 6 gal., when writing, give price, condition. Box 717 Modern Plastics, 122 E. 42nd Street, New York City.

PRACTICAL PLASTICS DESIGNER

A man who can create new items or restyle present items that will sell. Must be able to make up own samples in our plant.

A. S. Campbell Co., Inc.
161 Prescott St.
East Boston 28, Massachusetts

Chemist (Colored) experienced. Inventor-Patent Applied for, Magnetic Plastic. Now studying Plastics with Plastic Technical Industrial Institute Forum. Desires position in a plastic plant or research laboratory as an assistant. Have several inventions, Patent Pending, for household and gadget uses, which can be made of plastics. Write chemist Box 875, Modern Plastics.

WANTED SALESMAN WITH PAST EXPERIENCE SELLING COTTON FILLER FLOCKS TO THE PLASTIC TRADE.

CELLUSUEDE PRODUCTS, INC.
2107 Kishwaukee Street
Rockford, Illinois

WANTED
Industrial Designer

With creative ideas and proven experience. We have nation wide sales organization—designer will do no selling. He will meet clients and must have personality and ability to supervise large industrial accounts. Unusual opportunity for permanent position with growing organization of highest personal and financial integrity. Write fully. Strictest confidence observed.

DOHNER & LIPPINCOTT
500 Fifth Avenue, N. Y.
A Division of the Douglas T. Sterling Co.

Established textile concern wants experienced man to head department coating and impregnating yarns preparatory to weaving, etc. Duties will include production and development. All our employees know of this advertisement. Reply Box 880, Modern Plastics.

Plastic Engineer—Extensive experience in Marketing, Product design, Testing, Cost Estimation, and Production techniques of Thermo plastic extrusion. Desire consulting work with designers or general consulting engineers in New York Area. Reply Box 881, Modern Plastics.

For Sale: 15 x 15 hydraulic press 8½" ram, 17 x 17 Reversed Cylinder Press 8½" ram, 15" stroke; 200, 500, and 1000 ton presses, hydraulic pumps, accumulators, and operating valves. Aaron Machinery, 45 Crosby Street, New York City.

WANTED—PLASTICS CRAFTSMEN

Excellent opportunity for future by starting on ground floor with new development shop in application low pressure laminates. Experienced applicators, journeymen, sheet metal workers, upholsterers, patternmakers can qualify. State full particulars, age, dependents, draft status, present work, education, experience and salary expected. Location on West Coast with reliable firm.

Reply Box 882, Modern Plastics.

WANTED
Plastics Engineer

Well-known plant situated in Chicago territory desires services of experienced plastics engineer capable of setting up production line, designing dies, specifying equipment and conducting preliminary experiments toward setting up complete plastic manufacturing department. Good compensation and permanent future. Write full details Box 883 Modern Plastics.

Index To Advertisements

Accurate Molding Co. 186
Aircraft Screw Products Co. ... 46
Allied Plastics 69
American Cyanamid Co. 108, 109
American Insulator Corp. 183
American Photocopy Equipment Co. 181
American Plastics Corp. 180
American Screw Co. 34
Amos Molded Products 141
Atlas Valve Co. 183
Auburn Button Works 68
Bakelite Corp. ..Inside Back Cover
Baldwin Locomotive Works .. 47
Ball & Jewell 177
Bamberger, A. 192
Barco Manufacturing Co. 45
Behr-Manning 42
Birdsboro Steel Foundry & Machine Co. 64
Boonton Molding Co. 131
Bridgeport Molded Pdts., Inc. 187
Brilhart, Arnold Co. 113
Bristol Co., The 34
Broder, Harry 195
Buttondex Corp. 186
Cambridge Instrument Co., Inc. 183
Carver, Fred S. 186
Catalin Corp. 3
Cavagnaro, John J. 180
Celanese Celluloid Corp. 9
Celluplastic Corp. 50
Central Screw Co. 34
Chandler Products Corp. 34
Chicago Molded Products Corp. 57
Claremont Waste Mfg. Co. .. 114
Classified 197, 198
Columbia Protektosite Co., Inc. 151
Consolidated Molded Products Corp. 51
Continental-Diamond Fibre Co. 15
Continental Machines, Inc. 187
Continental Screw Co. 34, 173
Corbin Screw Corp., The 34
Corrosion Control Corp. 33
Cruver Mfg. Co. 165
Curran & Barry 189
Davies Molding Co., Harry .. 26
Delta Mfg. Co. 167
Despatch Oven 187
Detroit Macoid Co. 129
Detroit Mold Engineering Co. 190
Detroit Wax Paper Co. 175
Dillon-Beck Mfg. Co. 173
Disston, Henry, & Sons, Inc. .. 177
DoAll Co., The 70
Dow Chemical Co. 169
du Pont de Nemours, E. I. & Co., Inc. Plastics Dept. 7
Dures Plastics & Chemicals, Inc. ..... Inside Front Cover
Durite Plastics 35
Eclipse Molded Products 17
Electrix Corp. 194
Elmes Engineering Works of American Steel Foundries .. 13
Exact Weight Scale Co. 175
Exposition Chemical Industries 191
Federal Telephone & Radio Corp. 38
Foredom Electric Co. 185
Fortney Mfg. Co. 182
Franklin Plastics Division 174
General Electric Co. ..... Back Cover
General Industries Co. 43
Gering Products, Inc. 176
Girdler Corp. 14
Great American Plastics Co., The 20
Hanna Engineering Works ... 44
Harper Co., H. M., The 34
Hartford Chrome Corp. 12
Hercules Powder Co., Inc. 21
Hodgman Rubber Co. 181
Hydraulic Press Mfg. Co. 133
Ideal Plastics Corp. 190
Industrial Hard Chromium Co. 37
Industrial Synthetics Corp. 145
Insulation Mfg. Co. 179
International Molded Plastics, Inc. 196
International Screw Co. 34
Kearney & Trecker Products Corp. 153
Kingsley Gold Stamping Machine Co. 189
Kuhn & Jacob Molding & Tool Co. 193
Kurz-Kasch, Inc. 8
Kux Machine 56
Lamson & Sessions Co., The .. 34
Lane, J. H. & Co., Inc. 184
Lea Mfg. Co. 53
Lester-Phoenix, Inc. 49
Lincoln Engineering Co. 40
Lucidol Corp. 184
Mack Molding Co. 176
MacMillan Company, The ... 186
MacRae's Blue Book 194
Makalot Corp. 158
McAleer Mfg. Co. 50
Mead Specialties Co. 183
Mearl Corp., The 188
Mercer-Robinson Co., Inc. 178
Metal Specialty Company 24
Meyercord Co. 48
Mica Insulator Co. 54
Michigan Molded Plastics, Inc. 194
Midland Die & Engraving Co. 16
Mills, Elmer E., Corp. 30
Minnesota Mining & Mfg. Co. 178
Miracle Adhesives Corp. 193
Molded Products Co. 149
Monsanto Chemical Co. 139
Mosinee Paper Mills Co. 28
Muehlstein, H. & Co., Inc. 180
Munising Paper Co. 31
National-Erie Corp. 195
National Rubber Machinery Co. 5
National Screw & Mfg. Co. ..34, 74
National Vulcanized Fibre Co. 157
New England Screw Co. 34
New York Air Brake Co. 58
Nincet Chemicals Corp. 184
Nicholson File Co. 140
North American Electric Lamp Co. 188
Northern Industrial Chemical Co. 179
Northwest Syndicate, Inc. 32
Norton Laboratories, Inc. 36
Parker, Charles Co., The 34
Parker-Kalon Corp. 28, 34
Pawtucket Screw Co. 34
Pheoll Manufacturing Co. 34
Phillips Screw Manufacturers. 34
Plaskon Division 104, 105
Plastic Manufacturers, Inc. .. 128
Plastic Industries Technical Institute 30
Plastimold, Inc. 177
Porter-Cable Machine Co. 58
Pyro Plastics Co. 73
Rayon Processing Co. of R. I. 138
Reading Screw Co. 34
Recto Molded Products, Inc. .. 178
Reed-Prentice Corp. 10, 11
Reichhold Chemicals, Inc. 159
Reynolds Molded Plastics 22
Richardson Co. 6
Riegel Paper Co. 65
Rodgers Hydraulic, Inc. 163
Rogan Brothers 194
Rohm & Haas Co. 27
Royle, John & Sons 62
Russell Burdsall & Ward Bolt & Nut Co. 34
Sav-way Industries 18, 19
Schauer Machine Co. 189
Scoville Machine Co. 34
Shakeproof, Inc. 34
Shaw Insulator Co. 71
Sinko Tool & Mfg. Co. 41
Society of the Plastics Industry 136, 137
South Bend Lathe Works 60
Southington Hardware Mfg. Co., The 34
Standard Tool Co. 184
Stanley Works, R. L. Carter Division 192
Sterling Plastics Co. 161
Stokes, Jos. Rubber Co. 182
Stokes, F. J. Machine Co. 143
Taber Instrument Corp. 192
Taylor Instrument Companies 25
Tech-Art Plastics Co. 135
Tennessee Eastman Corp. 127
Thropp, Wm. R. & Sons Co. ... 185
Timken Roller Bearings Co. ..23, 67
Tinnerman Products, Inc. 63
Trav-ler Karenola Radio & Television Corp. 191
United States Testing Co., Inc. 147
Universal Plastics Corp. 181
Union Carbide & Carbon Corp. ..... Inside Back Cover
Varcum Chemical Corp. 52
Virginia Plak Co. 171
Waterbury Button Co., The .. 172
Watson-Stillman Co. 72
White, S. S. Dental Mfg. Co. .. 191
Whitney Screw Corp. 34
Wishnick-Tumpeer, Inc. 66
Wood, R. D., Co. 188
Worcester Moulded Plastics Co. 61

Modern Plastics Published by MODERN PLASTICS, INC. 122 E. 42nd St. NEW YORK 17, N. Y.

Better Seating

FOR BOMBER PILOTS TODAY

FOR EVERYONE TOMORROW

LOW PRESSURE LAMINATING PLASTICS! Today, they make possible the rapid molding in simple, inexpensive dies of complex shapes like the bomber pilot's seat. Tomorrow, they will be fabricated into large, sturdy shapes, such as scientifically contoured seats for homes, offices, theatres, buses, bicycles, and automobiles. The user will enjoy the added comfort and durability of this modern seating: while enterprising manufacturers will benefit from the production short cuts and economies made possible by these BAKELITE Plastics used in combination with wood, paper, and cloth.

Low Pressure Laminating is but one of many developments resulting from the application of BAKELITE Plastics to current essential needs. It is one of many reasons why industry should keep in touch with BAKELITE PLASTICS HEADQUARTERS—for information that will aid in the solution of present vital production problems, and for guidance in planning for the future.

Technical assistance will be provided by our Engineering Staff and Development Laboratories. Write for a copy of Booklet 15, "A Simplified Guide to Bakelite Plastics."

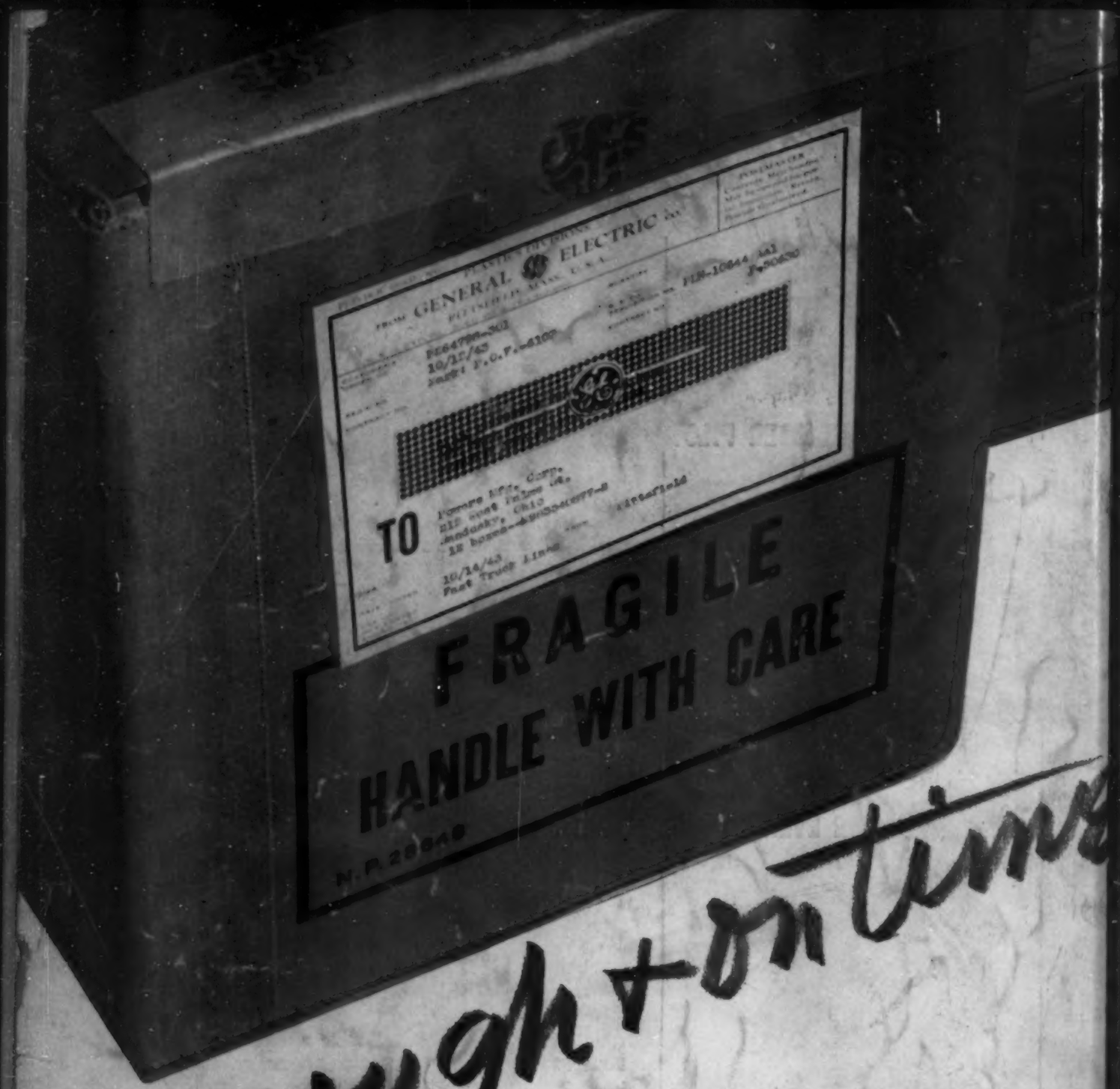
BAKELITE CORPORATION, 30 East 42nd St., New York, N.Y.

Unit of Union Carbide and Carbon Corporation

UCC

BAKELITE

PLASTICS HEADQUARTERS



enough + on time

The production of plastic parts in quantity to meet the most rigid specificatio
is not a new routine for the men and women of General Electric Plasti
Workers in every department have had years of pre-war experience buildi
plastic parts for essential Army, Navy, and civilian use.

The Plastics Divisions of General Electric are producing plastic parts tod
that far exceed in quantity and quality those of former years.

If you are building vital war equipment requiring plastics with unusual physic
or structural qualities, our nearest representative should be contacted imme
ately.

General Electric, the nation's largest molder, is prepared to put at the dispos
of any industry the facilities of its plastics plants and the knowledge of its p
sonnel. Whether the product you build is a spinning bucket, an electrical d
vice, a milking machine, or a steel mill, plastics can be used to improve
quality and performance.

For further information write section A-11, One Plastics Avenue, Pittsfield, Ma

GENERAL ELECTRIC

General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M.—E.W.T. NBC. "The World Today" news every weekday 6:45 P.M.—E.W.T.

Employees of the General Electric Company are on their jobs producing more goods and buying over a million dollars of War Bonds every week to hasten victo